IRON TRADE REVIEW
AND WESTERN MACHINIST

A JOURNAL OF MANUFACTURES, COMMERCE, INDUSTRY, SCIENCE, ART AND INVENTION.

WEEKLY EDITION. VOL. XVII—No. 4 | CLEVELAND, O., JANUARY 26, 1884. | MONTHLY EDITION VOL. II—No. 1.

I. H. PRATT

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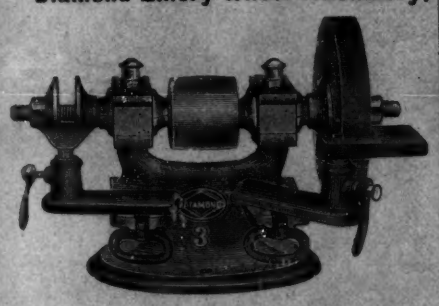

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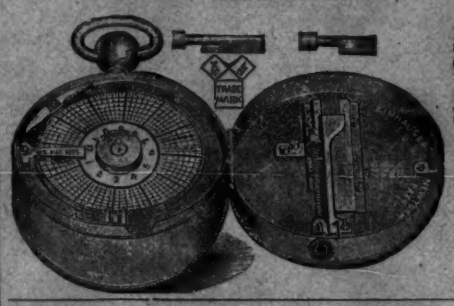

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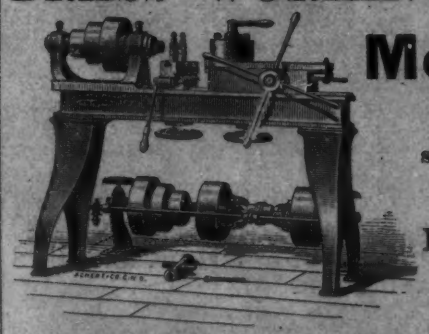

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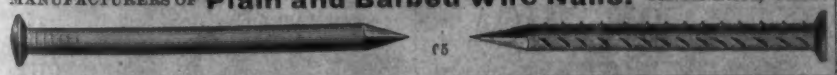

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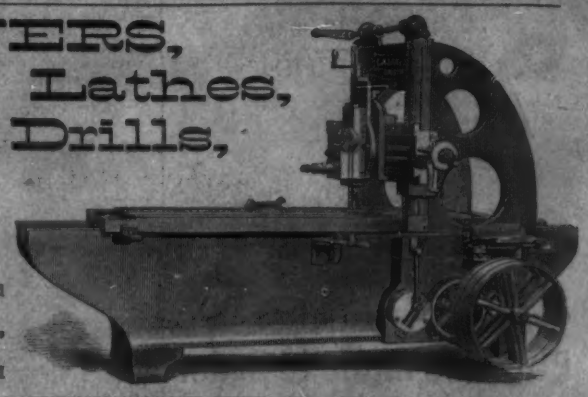

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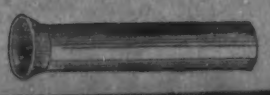

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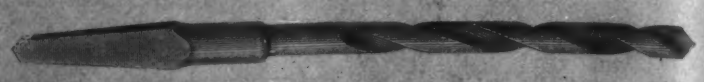

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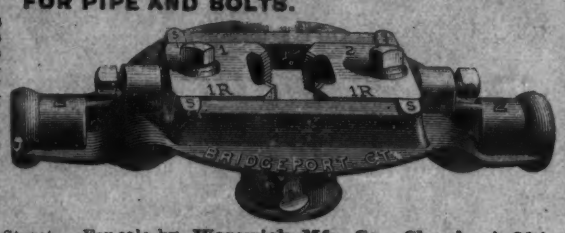

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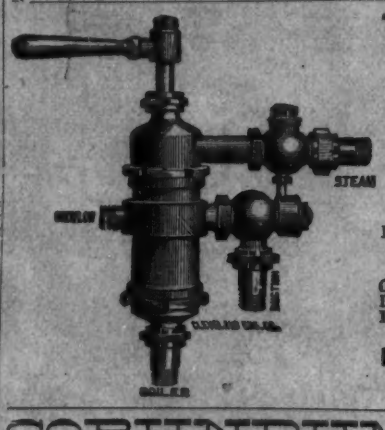

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AS WELL WITH HOT AS COLD WATER.

Cannot stop up or corrode. Always ready. Every Injector guaranteed to do what it is sold for,—Lifting or Non-lifting.

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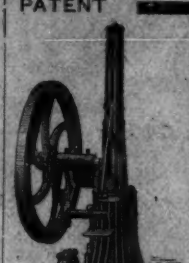

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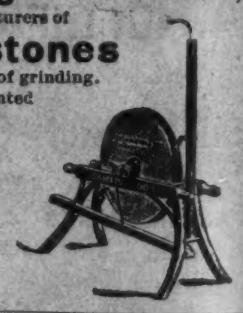

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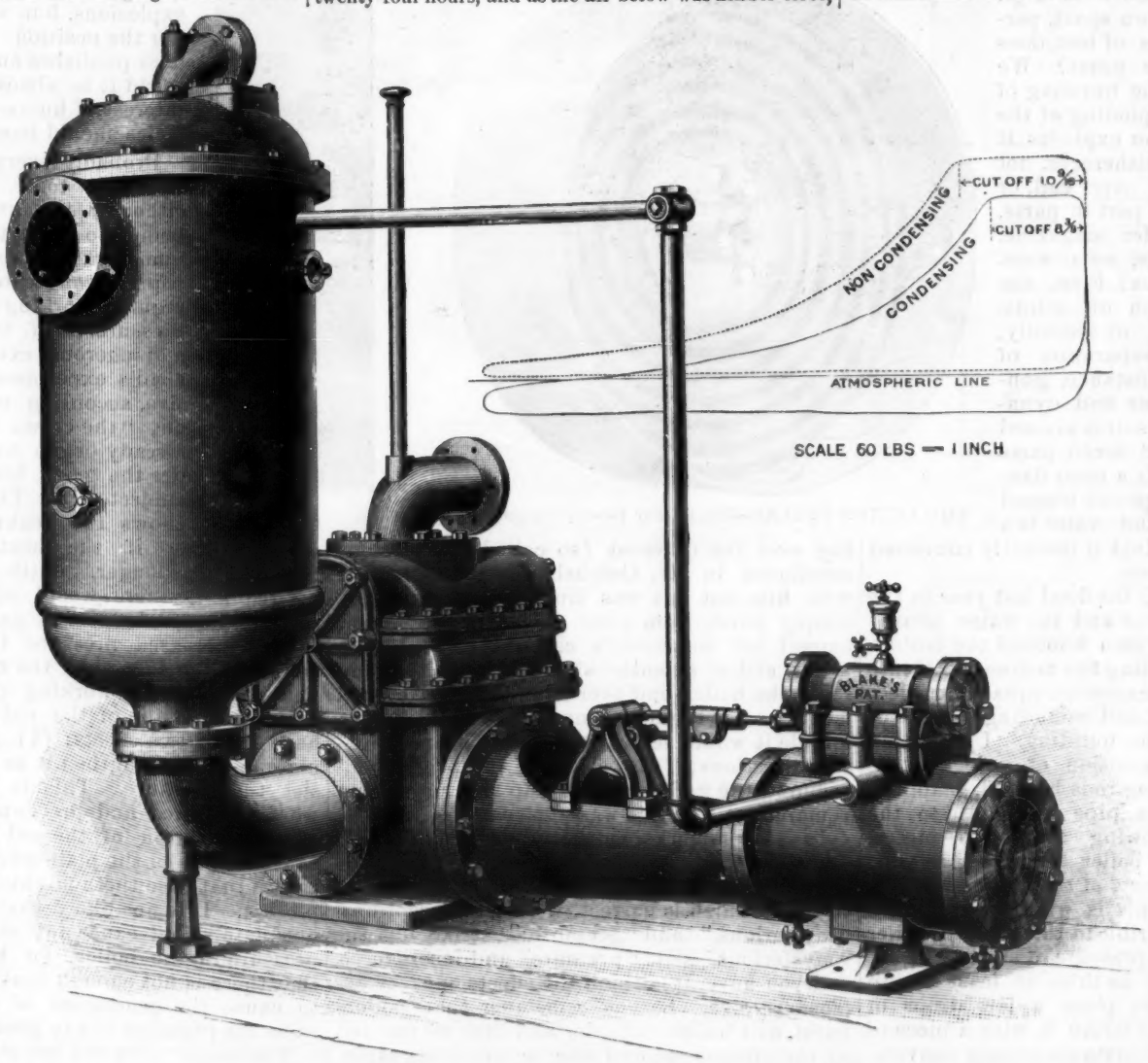
IRON TRADE REVIEW
AND WESTERN MACHINIST

WEEKLY EDITION, Vol. XVII—No. 4. | CLEVELAND, O., JANUARY 26, 1884. | MONTHLY EDITION Vol. II.—No. 1.

New Machinery.

Blake's Independent Air Pump and Condenser.

The Blake Independent Air Pump and Jet Condenser, herewith illustrated, is positive in its action, and is so constructed that under no circumstances can accident befall the steam engine by the "flooding" of the condenser and the water backing into the steam cylinder—a danger always imminent with the "injector" and "siphon" condensers or other forms of independent condensing apparatus. Having no mechanical connection with the steam engine, the air pump can be operated independently and a vacuum formed for the engine before it is started. The speed of the pump can also be regulated according to the temperature of the injection water and the requirements of the engine under different loads. The power necessary to run this machine is claimed to be only about one-half that usually consumed by regular connected air pumps. There is no drag on the engine, which is a very important feature, especially for high speeded engines that are now coming into such general use. The working parts are few in number and are compact, durable and well arranged. The apparatus is self-contained (no expensive foundation is necessary) and requires no additional pump for the injection water, or a head of water to supply the condenser. It will maintain a steady and uniform vacuum (and as high as may be required) no matter how variable the load on the engine may be. The lining, valve seats, piston rod, stuffing boxes, &c., of the air cylinder are made of the best gun metal composition; the piston is also made of the same material suitably packed. The amount of injection water required for condensing varies with the temperature—usually it takes from 1 to 1½ gallons per minute for each horse power developed by the engine, according to the season of the year and the source from which the the water is obtained.



BLAKE'S INDEPENDENT AIR PUMP AND CONDENSER.

The diagram given with the engraving represents copies of two indicator cards taken from a 24 x 48 inch automatic cut-off engine, with and without the Blake Air Pump and Condenser attached. The non-condensing card shows 70.3 lbs. initial pressure, with a back pressure of nearly one pound. The condensing card shows 57.5 lbs. initial pressure, and a vacuum equal to 12 pounds. The saving of steam here shown is over 30 per cent., by the removal of atmospheric and back pressure, and the consequent earlier closing of the cut-off valve. The mean effective pressure in each case is about 30 lbs. (speed, 64 revolutions per minute), therefore the power developed is about equal.

THE ENGINE-ROOM HAUNTED.

Why an Old Engineer Left a Good Berth.

New York Tribune.

"It's a queer story," replied the old man, with a mysterious shake of his head. "You see I had been the engineer of the Atlas about five years, when something queer happened. We were about three days out from New York on a return voyage. It had been raining for twenty-four hours, and as the air below was kinder close, I concluded I would leave the engine-room and go on deck for a sniff of the sea. When I opened the door and stepped out into the passage-way, I almost tumbled over a man who had evidently been peeping into the room through the keyhole. He jumped up as quick as he could and hurried away without axin' my pardon or makin' any explanation. However, I got a look at his face 'fore he went.

"He was a tall fellow with long black hair, hollow cheeked, sharp black eyes that seemed to burn right through a man, stoopin' shoulders and had a sneakin' dog-gone gait. When I went below an hour later, I couldn t help feeling that that queer fellow's eyes were following me. I sat down in a chair and tried to forget all about him, but I couldn't. I opened my door again to see if he was outside, but no one was there. I went to my berth, and lyin' down tried to get a wink of sleep, but it wan't no use. His face was forever staring at me out of the darkness. I tossed and turned all night long, but didn't get a moment's sleep. When I went down to the engine-room the next morning who should I find lyin' dead on the floor, his head crushed and his clothin' torn almost entirely from his body, but that same man I stumbled over the night before. My assistant told me that the fellow had come into the room on some pretence or other, and, when his back was turned, had jumped right in among the machinery and was crushed before the engine could be stopped.

"The queer part apout the accident was that nobody on board had ever seen the man before. Not one of the passengers was missing, and not a state-room or berth was empty. The body was buried at sea the following day. From that time on the engine room of the Atlas was haunted. At night, when a storm was brewing or the sea was very rough, the machinery creaked and groaned like a person in distress. In vain did we work over the bearings and friction parts. Still they creaked. The firemen in the hold said that the ghost of the dead man could be plainly seen on the third day of every voyage out from New York. Well, I ain't much of a believer in ghosts, but I tell you that after I had listened to the moanin' and creakin' of that engine for a week, and had the face of that fellow looking out at me from every hole and corner of the ship, I got nervous and dispirited. That's the reason why I left the Atlas."

Tinned Plate Industry.

Pittsburgh Telegraph.

Mr. John Jarrett, agent of the American Tinned Plate Association, is receiving the most flattering responses to the circular recently issued by him requesting cooperation in the effort of the Association to obtain protection for the American tinned plate industry. Encouragement has been received from all sides except from the importers, one of whom accused Mr. Jarrett of working to enrich himself and a few others. Mr. Jarrett retorted that if tinned plate was protected it would furnish employment to 6,000 men, and that nothing but selfish motives could actuate a man to enrich England and keep so many of his own countrymen out of employment.

Mr. J. D. Weeks, Secretary of the Western Iron and Steel Association, expresses the opinion that it is doubtful if a majority of the House will consent to the consideration of a Tariff bill this session.

Hints from Practical Men.

The Difference Between Exploding and Bursting.

TO THE EDITOR:

Having noticed an article on the cause of boiler explosions in the December number of your journal by A. C. Getchell in which he makes, as he says, "a broad assertion" that expansion and contraction have caused most of our boiler explosions, I wish to reply in this short article to his "assertion" and will prove, I think, to the readers of his article and mine, that he is decidedly off the track in regard to the cause of boiler explosions.

First, I would speak of the proper use of the word explode. Mr. Getchell in his article does not once speak of a boiler as bursting, but exploding. I deal with his article just as it is printed believing he means just what he says. If we take a bomb shell, fill it with water, screw an iron plug in the orifice, place the shell where the water will freeze, will the shell burst or explode? Burst, of course. If we fill the shell with powder and apply fire to the powder, does it explode or burst? Explode, to be sure, though a great many speak of a shell as bursting when it should be spoken of as exploding. If we apply the cold water pressure to a boiler and the iron plates are rent asunder, is it a bursting of the boiler or an explosion? The boiler bursts. If we take a boiler with a full supply of water, run the pressure so high that the boiler is torn apart, perhaps hurled hundreds of feet, does the boiler explode or burst? We must not confound the bursting of a boiler, with the exploding of the same. When a boiler explodes it will blow things to smithereens, not tumble a boiler end over end, or make a rent in some part or parts, but go up like a powder magazine, blow things to atoms, as it were. What is an explosion? First, the instanteous conversion of solids, or liquids into gases, or secondly, the instantaneous separation of gases by fire. For instance, gunpowder, nitro-glycerine and dynamite are some of the solids classed among the first; and seven parts of air to one of gas is a most dangerous explosive compound classed among the second; and water is a dangerous explosive fluid if instantly converted into its component gases.

For instance, during the flood last year in the East, a river overflowed and the water poured into a foundry. The men knocked the bottom out of the furnace, letting the molten metal into the water, causing an explosion equal, it seemed, to gunpowder, killing and wounding a score of men and wrecking the building. I have seen the effects of the explosion of a locomotive boiler. The connecting rods blew off, snapping the crank pins like a pipe stem close to the drivers, literally blowing things to pieces, hardly a piece of the boiler left as big as your hand; in fact, some parts of the engine went no one knows where. This is what we can call a genuine explosion, terrible to think of. A boiler bursting from a high pressure of steam will not do any such damage as this, at least not to such an extent. If we place a few drops of water on an anvil, and strike it with a piece of red hot iron, it will be instantaneously converted into its component gases with a report as loud as a rifle. What causes the explosion of these few drops of water? Two things: heat and the blow that strikes the water, causing the water to separate into small globules which are instantly converted into gases.

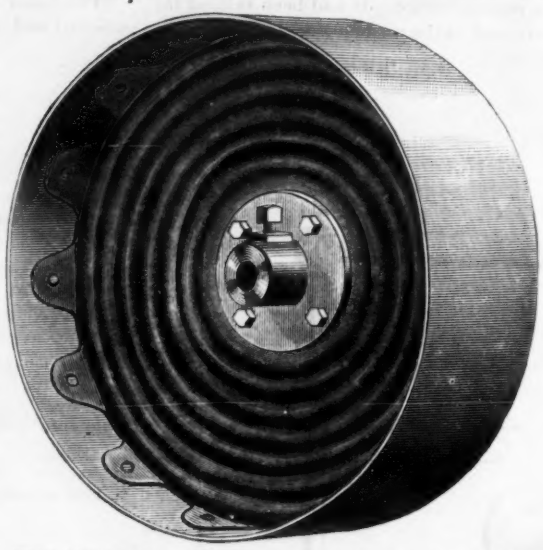
Now Mr. Getchell, after making his "assertion" comes to the conclusion that there are other causes for his boiler explosions, "scales accumulating on the shell, flues, tubes, &c., water being kept from the iron which causes it to become red hot and soft when by pressure it draws apart, and as the steam and water get freedom to expand, explosion (not bursting) follows," but he says "as for having low water and of pumping cold water on to hot iron, and causing steam to generate so suddenly as to make such terrible havoc, I think it impossible for the simple reason that you cannot get units of heat enough to make steam do so much damage."

Mr. Getchell overlooks one fact as regards his "units of heat generating steam enough to do such terrible damage." The boiler with low water may be carrying 100 pounds of steam pressure; the flues are not only red hot, but white hot about the water line.

Now for the simple facts as regards boiler explosions: Take a boiler with 2,000 square inches, 60 lbs. pressure, equals 120,000 lbs pressure already on the boiler; water low; flues white hot. The pump is started, and may be at the first stroke of the pump the boiler explodes with the force of a powder magazine, boiler, building, engine, men all blown to pieces, a general wreck, a genuine explosion, not a bursting from high steam. Now what happened inside this boiler when the pump was started? Just this: there were "units enough of heat" in the boiler to convert instantaneously the water pumped into the boiler into steam or gases, with 120,000 lbs. pressure already on the boiler and an instantaneous force (not pressure) applied from the instantaneous conversion of water into steam or gases, the boiler exploded. The tremendous force (not pressure) instantaneously exerted on every square inch of the boiler by the explosion of a small quantity of water in a boiler perhaps loaded with a 60 or 100 lbs. pressure to the square inch is what does the damage. In looking over the different (so called) explosions mentioned in Mr. Getchell's paper, I believe with him not one was from low water; they simply burst from some defect in the boiler, caused by somebody's carelessness. If the lower end of a boiler should burst, it would send the boiler end over end as Mr. Getchell mentions; if the boiler opened or burst in the middle it would send both ends in nearly opposite directions; if the bottom of an upright boiler burst, the boiler would go up and the bottom remain just where it was, for years perhaps.

In your remarks on the subject, Mr. Editor, you say "then there is the mysterious gas-and-sudden-generation-of-incalculable-pressure-theory" which is correct, with two exceptions "mysterious," and "pressure;" strike out the "mysterious" and "pressure" and insert force, and you have it—which the effects of every explosion prove. Let us remember that boilers burst, and boilers explode, and that we can tell by the effects produced whether the boiler exploded or burst. Few boilers explode; most of them are burst, which is bad enough; no boiler should be used that is not thoroughly inspected once in six months at least, by an honest expert. I saw a boiler inspected that leaked so bad that only 20 lbs. cold water pressure could be got on the boiler, yet the boiler was run for over a year with 50 or 60 lbs. steam pressure, a dangerous thing to do. Pardon me for so *short* an article.

ISAAC NEWTON.



THE FULTON PULLEY—FIG. 1. For Description see Page 59.

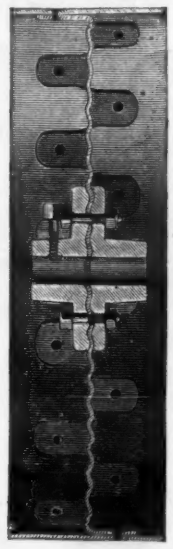


FIG. 2.

Will Low Water Cause a Boiler Explosion?

TO THE EDITOR:

You are circulating a very dangerous fallacy in publishing Mr. Getchell's opinion that low water cannot cause boiler explosions. The argument that because Mr. Getchell was once on a locomotive which had the crown sheet uncovered and then had cold water let in directly on the hot plate and the locomotive did not explode, therefore no boiler will explode under similar circumstances, is about as sensible as to say that if he once stood in front of a loaded gun and the cap snapped without exploding the charge, that it would be perfectly safe for him to repeat the experiment.

If the Mr. Getchell you quote is the same person who is, or was recently, Inspector of the Hartford Boiler Inspection & Insurance Co., he ought to be better informed than to give circulation to any such dangerous theory. We have heard, however, of other theories of Inspector Getchell's concerning boiler explosions which while not so dangerous as the one above referred to, were nearly as absurd. For instance, a boiler at the Erie Car Shops, Erie, Pa., exploded, and Mr. Getchell testified that the cause of the explosion was due to the alternate heating and chilling of the plates of the boiler by the opening and shutting of the fire door. Some such theory as this was given by him in evidence at the Coroner's inquest, while the facts were that the sheet of the boiler which exploded was in the rear end of the boiler farthest away from the fire door, was a new sheet, put in the boiler within a year from the date of the explosion, while the front sheets of the boiler, which had never been repaired, did not explode, and were 12 or 13 years old. It is bad enough for firemen and engineers to have wrong theories concerning boiler explosions, but when a man holding the position that Mr. Getchell does publishes such theories to the world it is almost necessary in the interest of human life that his fallacies should be shown up.

Probably every boiler explosion that ever took place was caused either by the shell of the boiler being too weak to sustain the regular working pressure, or the shell being strong enough to sustain the regular working pressure, by the pressure itself being increased to a dangerous extent. In Mr. Getchell's experiment on the locomotive, according to your recent article, "the crown of the boiler had already begun to lose its shape under the great heat to which it was subjected." This losing shape shows the weakness of the sheet when heated; if the heating had continued a little longer, until the crown sheet got red hot, there would either have been a rupture, or a dangerous explosion, due, not to any increased pressure in the boiler, but simply to the fact that the red hot sheet was unable to sustain working pressure. Putting cold water on top of the red hot sheet might have one of two effects: (1) It would cool the plate and so strengthen it as to enable it to resist the pressure. This is probably exactly what happened and prevented the explosion. (2) Contraction of the red hot plate might cause strains in the plate which would crack it, and in that case there might be a dangerous explosion. It is not likely that the water on the hot plate would cause any material increase of pressure in the boiler, for the simple reason that there is not enough heat in a red hot plate to cause the generation of enough steam to raise the pressure to any great extent.

The danger of a red hot plate in a boiler is: First, that the plate is weakened. Second, that if, before weakening to the extent of being unable to sustain the pressure, it is suddenly cooled it may crack. In both cases low water may be the cause of a very destructive explosion.

The opposite of Mr. Getchell's theory is very commonly held among some boiler users, viz: that the only cause of explosion is low water. This is fully as erroneous as the other, for there may be several causes besides low water.

Your article states that repeated experiments have failed to explode boilers through this agency (low water); other repeated experiments have shown that low water will cause explosions, and the latter experiments are much the more numerous. The conclusion is that low water

[Concluded on Page 53.]

PUMPING ENGINE OF THE PERIOD.

COMPARISONS OF DUTIES BY DIAGRAMS TAKEN FROM ENGINES IN ACTUAL PRACTICE.

Operation of the Valves and the Effect of Pistons on the Column of Water.

BY E. H. MARTIN*

(Chief Engineer of the Cleveland Rolling Mill Co.)

The subject of this paper will be some thoughts and statistics of the pumping engine of the period; with comparisons of duties by diagrams taken from engines in actual practice showing the practical operation of the valves, and the effect of the pistons on the column of water, &c., of almost every class of pumping engine in general use for raising large quantities of water, but more particularly for water works purposes; and after hastily reviewing the duties of the various types of pumping engines of early and modern date, I purpose briefly to consider what are the elements necessary for the practical development of the greatest amount of duty for the least current expense; or for a given current expense (all other excellencies being equally assured) what type of engine will yield the greatest duty. For the theoretical elucidation of this subject let me refer you to Rankine, Bourne, and the elaborate papers of Professor Robinson in the Transactions of the American Society of Mechanical Engineers, Vols. 1, 2 and 3. I shall confine my remarks to the practical consideration of the subject and shall appeal only to facts and figures which are verified by substantial proof.

We find the newspapers teeming with reports of wonderful tests of the different types of pumping engines and calling to mind the immense improvements made in the engines of this period over those of earlier date; but after careful comparison of the most popular pumping engines of modern date with those of earlier date, I have concluded that those critics must refer to the improvements in the painting or other outward embellishments—it certainly is is not in the increase of duty, neither is it in durability, nor in immunity from accident or depreciation in regular wear and tear, nor, to my mind, in appearance or simplicity of construction. And with your permission I will refer to a few cases going back over a period of 40 years.

At this time Mr. Joshua Field, of the firm of Mandsley Sons & Field, London, was consulting engineer for the London Water Works Co.; at this time the duties of their engines were over 100,000,000 foot pounds for a consumption of 94 lbs. of Welsh coal. In the year 1839 the average duty of the Cornish engines was 54,000,000; in 1849 it was over 60,000,000; in many cases it was much higher, to-wit: at the consolidated mines in Cornwall, England, in the year 1834 the average was 58,000,000 and two engines reached 67,000,000. In the same year one of the engines of the Fourey Consols mines made a duty of 125,000,000, during a 30 hours test, and a friend of mine who saw the engine last year informed me it was as good then as when built, as far as he could judge.

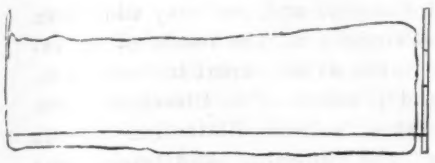
I could go on quoting indefinitely, but this is not necessary here, but I have quoted these to make comparisons in the matter of duty and durability, &c.; and although Mr. Worthington in his pamphlet to the Committe on Hydraulics at the Centennial Exposition at Philadelphia endeavored to show these duties named above were fallacious, I think we have no right to question their truth, any more than we have to doubt the following modern duties. These are average duties of pumping engines at the following places for the past three years:

Buffalo, N. Y.	43,000,000	Chicago,	32,000,000
Cleveland, O.	39,000,000	Milwaukee Corliss	94,000,000
Columbus, O.	48,000,000	Toledo,	38,000,000
Philadelphia.	43,000,000	Toronto, Canada,	41,000,000
Providence (Corliss)	103,000,000	Lynn, Mass., (Leavitt)	76,000,000
Brooklyn, N. Y.	49,000,000		

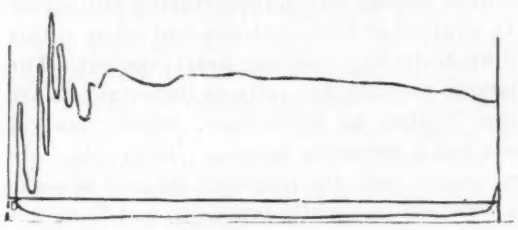
This represents almost every type of engine now in general use. It includes the Cornish, Worthington, Holley, Leavitt, Corliss and others.

Although I have thought proper to call your attention to the splendid duties obtained from the Cornish engines, it would be folly to think of advocating them as being the type of pumping engine for water works purposes at this period, for various reasons not necessary to name here. But it will be noticed in the list of duties of modern engines given above there are two which in regular duty compare favorably with the high duties of the Cornish engines or any other engines known to me. And here will follow the question: How or by what means are these duties obtained, and why do the others not accomplish the same results? The answer is: It is accomplished by high ratios of expansion and quicker piston speed; and the reason why the others fall short is because they are unable to take advantage of these essential elements. There are other reasons, but these are the main source from which the real economy is derived, and I may say the duties are of the most flattering kind.

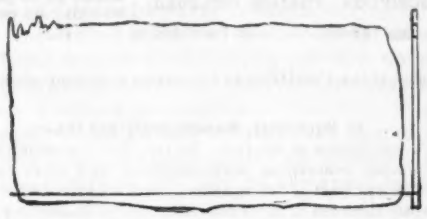
I have believed for many years that there is no reason why pumping engines should not be



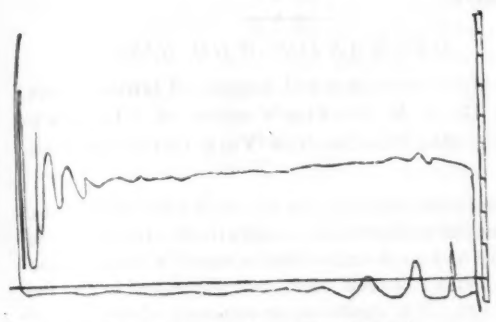
No. 1—The Shields Engine, Cincinnati.



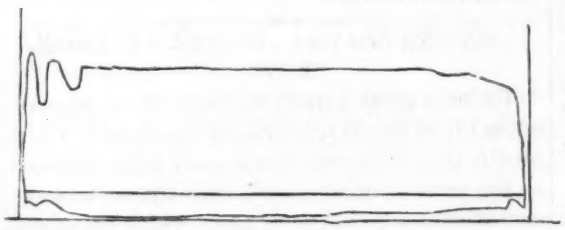
No. 7—Crank Engine, Chicago.



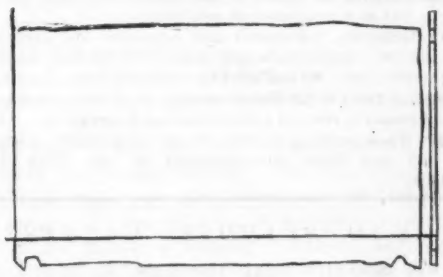
No. 9—Cornish Engine, Philadelphia.



No 2—Crank Engine, Cincinnati.

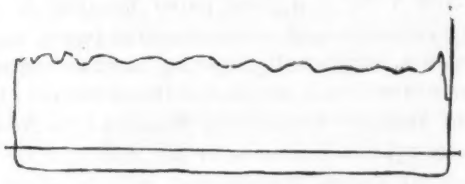


No. 8—Crank Engine, Chicago.

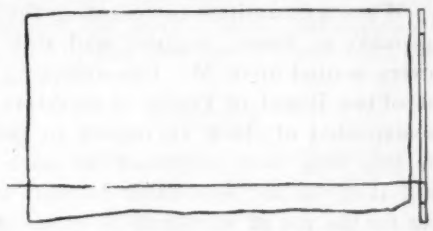


No. 10—Worthington Engine, Newark, N. J.

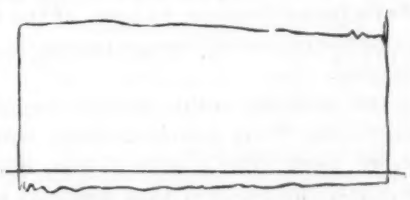
No. —3 Crank Engine, Cincinnati.



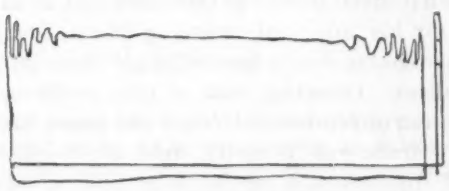
No. 5—Wright Engine, Trenton, N. J.



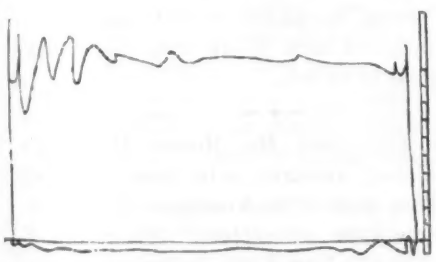
No. 11—Worthington Engine, Salem, Mass.



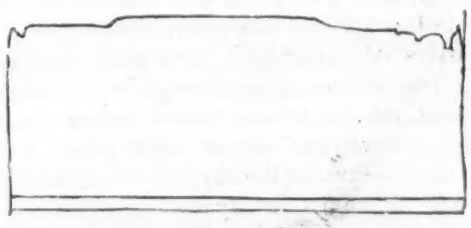
No. 6—Crank Engine, Fall River.



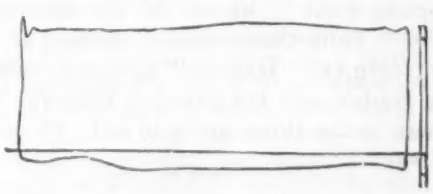
No. 12—The McAlpine Engine, New Bedford, Mass.



No. 4—Leavitt's Compound Engine, Lynn, Mass



No. 14—Crank Engine, Brooklyn, N. Y.



No. 13—The Same Engine.

INDICATOR DIAGRAMS FROM WATER CYLINDERS.

*Read before the Civil Engineers' Club of Cleveland, January 8, 1884.

Continued on page 54.

IRON TRADE REVIEW
AND
WESTERN MACHINIST.

ESTABLISHED 1868—SEVENTEENTH YEAR.

Devoted to the Manufacturing, Scientific, and Mechanical Interests of the Country.

PUBLISHED EVERY SATURDAY.

Office—Rooms 30 and 31, Board of Trade Building,
122 Water street,
CLEVELAND, OHIO,

TELEPHONE 852.

WILSON M. DAY, - - - - - - Editor
FRANK N. CARTER, - - - - Business Manager

SUBSCRIPTION, (POSTAGE INCLUDED). { Weekly $3.00 per Year. Monthly .60 per Year.

☞ Advertising Rates Furnished on Application.

Entered at the Post Office at Cleveland as second-class matter.

To Machinists, Manufacturers and Others.

THE publishers of the IRON TRADE REVIEW solicit items of information concerning manufacturing and other establishments in any part of the country, and all such items will be promptly inserted in these columns, free of charge. Facts are the only things needed; and all communications should be accompanied with the name of the contributor—not for publication—but as a guarantee of good faith.

Manufacturers, machinists and engineers are particularly requested to communicate any matters of interest relating to their specialties. No one need be deterred from sending any interesting facts in his own language, as all such contributions will be properly revised before sending to press.

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AS TO "STANDARD GAUGES."

So it appears that the new standard wire gauge of Great Britain is not "standard," after all. When a committee representing the sheet-iron makers, brass, copper, and zinc metal workers waited upon Mr. Chamberlain, President of the Board of Trade, to ascertain what was expected of them in regard to the new standard, they were surprised to learn from him that it was not applicable to their trades, being for the use of wire-makers only. At the same time he advised them to fix upon a standard flat metal gauge of their own and to submit it for his approval, warning them that any other course would be sure to get them into difficulties. Growing out of this conference, a meeting of representatives of the above branches of trade was recently held, at which, after full discussion, a motion to accept the new legalized wire gauge was voted down and a resolution went through by a decisive majority adopting what is known as the Birmingham gauge. Thus the precedent has been set of establishing two "standard" gauges to suit separate trades, and the question naturally arises, Where is the thing going to end? There is no telling.

A DEPARTMENT OF INDUSTRY.

Congressman Foran, of this district, has favored us with a copy of his bill to establish and maintain a Department of Industry. It defines, as the work of such a department, the acquiring, collecting, assorting, systematizing and diffusing among the people of the United States of statistical details and useful information on all subjects connected with industry (save agriculture, which already has a special department), in the most general and comprehensive sense of the word, and especially in its relation to the commercial, material, social, educational and sanitary conditions of the laboring classes. Over this department it is proposed to place a Commissioner of Industry, at a salary of $4,000 a year. His assistants are to be a chief clerk, a statistician, a physician and chemist, a professor of technology, an inspector of mines, workshops, mills and factories, a librarian, etc. The work of the physician and chemist is to respond to the call of any organized body of workingmen, or any employers of labor, in respect to ventilation or sanitary matters; that of the inspector to decide upon the safety of construction of buildings, machinery, etc. Among the duties of the commissioner will be the prosecution of practical and scientific experiments; the recording of all new and approved processes in manufacture, new machinery, apparatus and appliances discovered or applied in this or other countries, and the issuing of monthly bulletins giving the results of his labors, and containing practical papers on scientific and technological subjects pertaining to mechanical, mining and manufacturing industries.

In support of both the letter and spirit of this bill we desire to record our hearty assent. The interests affected are fully as important as are those related to agriculture, which has for years had a separate bureau. Both the object sought and the proposed manner of seeking them are eminently practical, and Congress will do itself, as well as the country at large, an injustice, if it fails to take early and favorable action on this bill.

"SENSATIONAL WESTERN IRON NEWS."

To be a great paper (we judge from appearances) it is necessary, first, to studiously avoid mentioning the name of any other paper devoted to the same specialty, and secondly, to treat as sensational any matter of news which emanates from any source not its own. The *Iron Age*, of New York, is a great paper because it is a very complete and comprehensive paper, but it is also a very small paper in the two respects above mentioned, as witness its editorial of last week headed "Sensational Western Iron News." To its evident reference to the *Age of Steel* we have no doubt that journal will be ready to make a prompt and effective reply, giving good grounds for its publication, as news, of the facts concerning the proposed (though impracticable) pig iron pool.

As to the allusion to this journal, regarding the description of the new Minnesota iron ore district, we have simply to say that, while it was perfectly understood that previous references to this district, more or less extended, had appeared in print, this was the first complete description of the same; covering as it did, matters of topography, geological formation, analyses of ores, present development, proposed output, etc., which had never before appeared in any newspaper—upon which point, backed by the approval of the gentlemen composing the syndicate, we are entirely content to rest our case. Respecting the propriety of sending out a telegraphic condensation of the article, we presume the wide awake Cleveland correspondents are best prepared to judge, without seeking counsel and advice away from home. Lastly, we desire to remark that this paper does not deal in sensations; its mission is to get hold of the news. If occasionally it gets "left," it will have the grace at least not to betray its chagrin by "lecturing" its more enterprising contemporaries.

EXPLODING THEORIES AND THEORIES OF EXPLOSIONS.

Two intelligent correspondents make in this issue a vigorous attack, from different standpoints, upon Mr. A. C. Getchell's theory as to boiler explosions, *i.e.*: that explosions cannot take place from letting cold water upon hot plates. Our New York friend makes some excellent points but is not quite broad enough in his criticism regarding the circulation of "a dangerous fallacy." If to bring to public notice the various theories touching boiler explosions is a cause of offending, then we fear Mr. Getchell will have to at once make his peace with the boiler inspection and insurance company which he represents; the Cleveland Civil Engineers' Club will need in the future to limit its discussions to non-debatable questions; the official journal of its transactions will come under the common censure, and the hundred and one scientific and trade papers throughout the country who have copied the substance of Mr. Getchell's article from this journal must solemnly promise not to do so any more. Seriously, however, "Boiler" puts his case succinctly and forcibly, and, we may add (from personal knowledge), as the result of an extended experience as an expert in boiler construction and practice. Our Cleveland correspondent makes a nice distinction between "exploding" and "bursting" and brings out a number of very interesting and valuable points. We shall be glad to see the subject still further pursued.

MECHANICS WHO RISE.

There is a large sized nugget of truth in this from Dr. J. M. Buckley's series of "Letters to Young Men," in the New York *Christian Advocate*:

"Benjamin Franklin told the truth when he said that the best knowledge a man could give to his son was the mastery of a good trade. Such a man is a cosmopolitan. He can make himself useful anywhere, and he can live anywhere. If it should not be necessary always to work at his trade, he feels the ability within to support himself. * * * Between the average mechanic and the great manufacturer or merchant prince, great numbers can be found who began as mechanics and who have taken positions by their mechanical skill fully equal to that of the average merchant and far superior to that of most clerks and professional men. * * * Always have in view rising above the position of a mere journeyman. Look at things from a broad business point of view. Consider that some day you may not be a journeyman, and try to study the relations of capital to labor, and to master the principles of business, so that if you should ever form a partnership with a business man, you will not be at his mercy, and so that, if you choose, you may at any time enter upon business for yourself, and not fritter away your life in a vain effort to overcome by mechanical skill financial obstacles."

Every young mechanic should cut out the above extract and tack it up over his bench. It is too good to be lost.

WRITING to correct Mr. Robert P. Porter's mistake (already referred to in these columns), in saying that most of the American steel works "use only two-ton converters," Mr. Frank S. Dodge says in the New York *Tribune*:

"From a general study in one of the large Western mills, and visits to most of the Bessemer works in this country, I may be allowed to say that a large majority use "ten ton" converters, and many of the others are of six and seven ton capacity. For instance, the "Cambria" Company, at Johnstown, Pennsylvania, the "Edgar Thomson," "Pittsburg Bessemer," and others near Pittsburg, the new Scranton mills, those at Cleveland, Ohio, Joliet, Illinois, the North Chicago Company and the Union Iron and Steel Company in Chicago, all but the last use the largest size, and the last mentioned company was preparing for the change from six to ten ton converters at the time work was suspended last spring."

Mr. Dodge justly insists that America shall not be made to take second place in steel making.

THE IRON TRADE REVIEW, in commenting upon the many divisions of engineering and the improper application of the word, says:

"Last, but not least, the most mysterious title of 'Traveling Engineer,' is applied to a gentleman con-

nected with a Western railroad—though what that means nobody has yet been able to find out."

A traveling engineer on a railroad is one who goes from division to division, and exercises a general supervision of the runners. He gets on and off of locomotives all along the road, listens to the drivers' complaints of defects, and sees whether they are just or not. He is generally one of the oldest men on the road, and his word is law in his province.—[Mechanical Engineer.

We are under obligations to the *Mechanical Engineer* for the above information. It but enforces our objections to the too promiscuous use of the word "engineer." What has the supervision of runners and the hearing of complaints to do with the science of engineering?

THE life of the machine shop foreman or employe is open to peculiar hazards. At Sidney, Ohio, recently, Michael Smith, foreman of P. Smith Bro. & Co.'s foundry and machine shop, was superintending the casting of brass fittings. It is presumed that the imperfect draft of the furnace permitted carbonic acid gas arising from the crucible to collect in the furnace. A small door in the top of the furnace and immediately over the mouth of the crucible was opened by Mr. Smith to examine the boiling compound. A volume of gas escaped and was inhaled by him. He fell backward on a heap of fuller's earth and was seized with convulsions, ending in his death two days after.

Little faith is put by a contemporary in the likelihood of either English or American manufacturers substituting ropes for leather belts for driving machinery. "The English manufacturers," it says, "have never had a full idea of how power could be conveyed by leather belting until we taught them." Since, then, it has been so hard to get them out of the use of gearing and into the adoption of belting, it is argued that it will be going to the other extreme to take to rope traction. May be, but we hear of a number of instances where rope has been put in and is working very satisfactorily. Of course any general change is not to be expected.

A SKILLED Cleveland machinist, lately returned from China, describes the average Chinaman as excessively dull in comprehending, and as exasperatingly conservative in taking up with, modern machinery. Content with the old, laborious methods, because they afford employment to the greatest number, the Celestials look askance at innovations and do not try to study their advantages. The ordinary Chinese assistant about an engine room would be a perpetual trial of patience were not his very dullness the source of continual amusement.

The Cleveland Rolling Mill Co. have taken orders within the past six weeks for about 25,000 steel rails, and expect to be running in full blast about the 1st of March. Their plate, hoop, rod, bar, guide and wire mills are all running full.

DURING 1883 there were inspected in the Cleveland district 178 marine boilers, only three of which gave way under hydrostatic pressure. One boiler only was condemned from further use. Ten were found defective.

IT is not always improved methods of doing things in our shops that are needed, so much as honesty in applying methods already tested and approved.

THERE are a good many indications favorable to a prosperous year for the machinery trade generally throughout the country.

ADVERTISE in the IRON TRADE REVIEW.

POOLING THE IRON OUTPUT.

LETTER FROM THE ORIGINATOR OF THE PROJECT.

Pledges Received from Very Many Prominent Concerns, But Pittsburg Objects.

Respecting the proposed pooling of manufactured iron and pig iron interests, the following letter from Mr. E. L. Harper, of the well-known firm of E. L. Harper & Co., Cincinnati, contains several new points of importance and sufficiently explains itself:

E. L. HARPER & Co.,
30 WEST THIRD ST.,
PIG IRON, ORES & RAILS,
CINCINNATI Jan. 22, 1884.

Mr. W. M. Day, Editor Iron Trade Review & Western Machinist, Cleveland, O.

DEAR SIR: I am in receipt of your esteemed favor 21st inst. and thank you for the courtesy of the use of the columns of your valuable journal in which I might elaborate the suggestions set forth in my recent circular looking to an organization of Rolling Mill proprietors. My object, as indicated, was to avoid the mercurial fluctuations that afflict the trade, and to secure ourselves against overproduction in seasons of great depression and the extremely low prices incident to such seasons, thereby assuring buyers as well as producers a more evenly balanced market, and the mills a safer condition in times of comparative inactivity.

I have received from very many prominent concerns pledges that they will identify themselves with the organization contemplated, but at this writing probably an insufficient number to warrant the call of a convention. Pittsburgh is inimical to the plan; so far as the mills I am so largely interested in are concerned it is likely that none are more advantageously located, and we are able to produce manufactured iron at as low cost as anywhere in the Union, but it would be gratifying to adopt some measures for the protection of our common interests, and a plan may yet be adopted that will secure the hearty approval of all concerned.

Very truly yours, E. L. HARPER.

Accompanying Mr. Harper's letter is a copy of his circular, as follows:

"MANUFACTURED IRON POOL."

Plan of a proposed organization to curtail the production of Manufactured Iron and control the price of same, to be binding one year unless otherwise agreed by vote of the organization, providing nine-tenths of the Manufacturers of finished Wrought Iron in the United States join the Association.

It is proposed to divide one share of stock to each member for every 100 tons of manufactured iron produced by such member within the last twelve months. This will divide the shares in proportion to the capacity of each mill, and after organization to assess each mill a per cent. for each ton of iron produced by it monthly and to declare dividends monthly to each mill in proportion to the shares held by it.

The amount of the assessments will be governed, from month to month, according to the price of manufactured iron—the lower the price the larger the assessment, and vice versa.

This will encourage mills holding shares to shut down, or curtail their production, and will regulate the prices ruling, so that parties running their mills full will receive prices to justfy their paying an assessment greater than the dividend received, or should the mills in certain districts close down from any cause they can do so and receive their dividend monthly, which will enable them to stop without loss.

For example, assuming that three mills of equal capacity manufacture all the iron consumed, say 90,000 tons:

A's capacity	30,000	tons,	holds	3,000	shares	stock.
B's "	30,000	"	"	3,000	"	"
C's "	30,000	"	"	3,000	"	"

And the prices would not justify all their mills running, or supposing some may wish to reduce expenses, then A will close down for reasons herein explained, B will run and make 20,000 tons, C will run full and make 30,000 tons, the assessment being say $\frac{1}{10}$ or $2 per ton.

A no assessment to pay,	
B $2 per ton on 20,000 tons,	$40,000.00
C $2 per ton on 30,000 tons,	$60,000.00
	$100,000.00

The dividends would be:

A one-third,	$33,333.33⅓
B one-third,	33,333,43⅓
C one-third,	33,333.33⅓
	$100,000.00

According to this example you will see that A has received for stopping the sum $33,333.33⅓. B has curtailed his production, and pays an assessment of $6,666.66⅔ in excess of his dividends. C has run full, and pays an assessment of $26,666.66⅔ in excess of his dividends; but both B C have received prices sufficiently higher to pay this assessment, and make a good profit.

I estimate that by a reduction of about 40 per cent., the selling price of iron would be increased one quarter of a cent per pound, and this would give the party manufacturing 30,000 tons, the sum of $150,000.00 less his assessment of $26,666.66⅔, or $123,333 33⅓ per annum more for his manufactured out-put for one year than he would otherwise receive.

Should this plan meet with the desired approval, it is intended to organize an association of manufacturers of pig iron on the same basis.

Respectfully submitted, E. L. HARPER.

CINCINNATI, O., December 1, 1883.

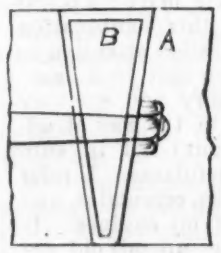
The subject thus opened up is a most interesting one, and we invite further correspondence in the same line.

Singular Question.

Mechanical Engineer.

We find in an English contemporary, whose name is purposely omitted, the following:

"Will some one enlighten me on the following point: Suppose *B* to be a piston in a cylinder *A*, so made that the rings at the top are wider than at the bottom, the piston thus being taper in section, will not this construction cause the wear upon the cylinder to be less at the bottom, the weight upon the piston being sustained by the pressure of steam on the inclined faces?"



This paper has a plan of publishing the question one week and the answer to it the next week, so that our inquiring friend above will be kept in a state of suspense for that time.

Short Way to Form a Gear Tooth.

Mille s' Review.

M. Poncelet, a French mechanical engineer, has given the following very easy method by which the form of a tooth of a wheel may be found approximately, which will work truly with a tooth of any given form on another wheel. Without being mechanically exact, the result will be sufficiently accurate for all practical purposes. Suppose the given tooth N upon the one wheel to be placed in the position in which it is first required to engage or disengage from the tooth on the other wheel, and let A a and A b be equal arcs of the pitch circles of the two wheels point of contact is A. Draw A a the shortest distance between A and the face of the tooth N; join a a; bisect the line in M, and draw M perpendicular to a a intersecting the circumference A a in n. If from the centre n, a circular arc be described passing through the points a and a, it will give the required form of the tooth, very nearly.

COMMUNICATIONS from practical men on practical subjects are always desired.

PUMPING ENGINE OF THE PERIOD.

Continued from Page 51.

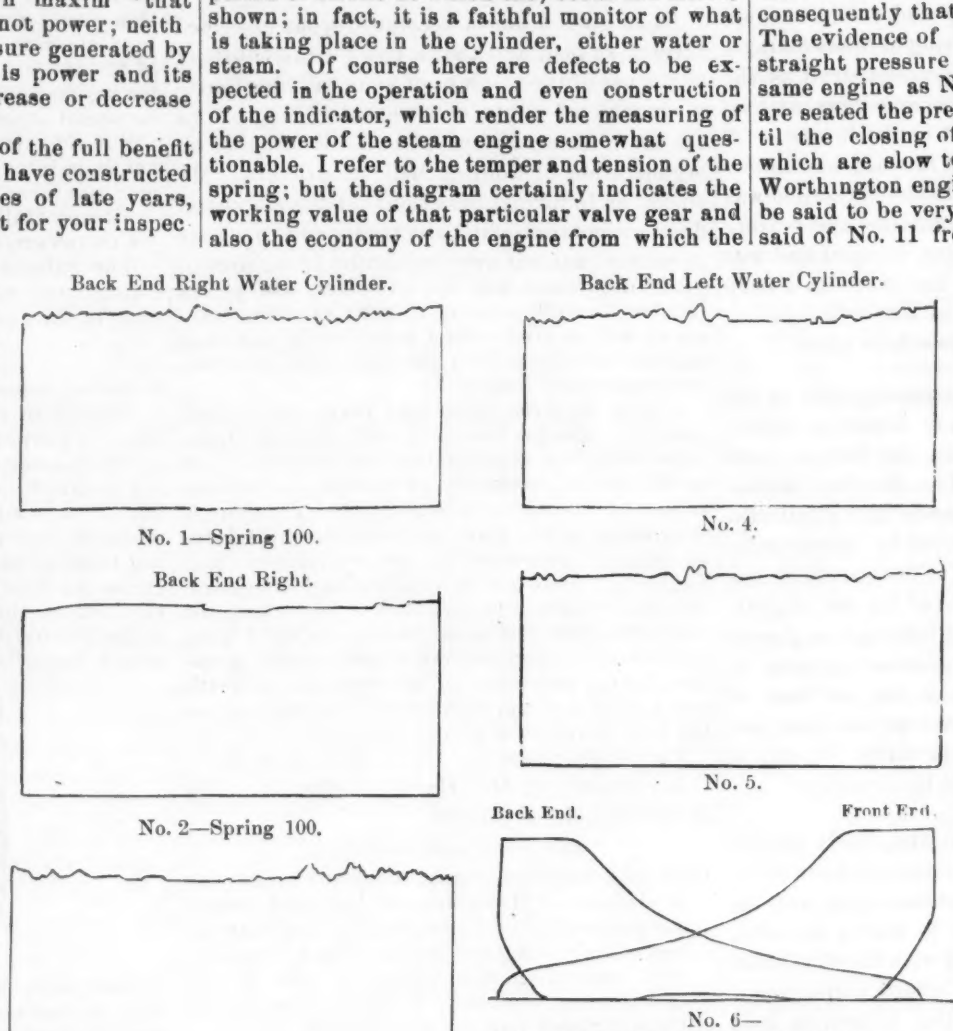
built, which shall cost but little more, occupy no more space, require no more foundations, be more easily managed, have equal immunities from frequent and expensive repairs; in fact, possess all the good qualities contained in the direct-acting engine and in addition perform a regular duty of 100,000,000, foot pounds per 100 lbs. of good coal.

I have said the elements necessary to achieve this are high ratios of expansion and quick piston speed; neither of them separately will accomplish it. Excessive expansion without proportionate speed would be a detriment; and high speeds cannot be used. Although theoretically I suppose there is scarcely any limit to the above two elements applied to the engine, yet in practice we soon reach the limit. The above proposition, in my opinion, is equal to acknowledging the well-known maxim "that heat is not power; pressure is not power; neither is velocity power; but pressure generated by heat combined with velocity is power and its value is measured by the increase or decrease of either element."

In order to take advantage of the full benefit of high speed and expansion, I have constructed a number of pumping engines of late years, designs of which I here exhibit for your inspection. After years of experiment and study of the subject, I have concluded that the only means by which we can couple the two elements so as to get the full benefit of both in the pumping engines is by gearing. I am fully aware that great antipathy exists with numbers of the engineering profession against gearing for pumping engines, but have always been at a loss to understand just why, unless it has been that we have failed to construct our gears properly. There are also other popular objectionable mechanical features in this combination frequently called attention to by inventors that look beautiful in theory and are very reassuring in the way of advertising, but fail in substantial usefulness. I refer to the cranks, eccentrics, and fly wheel, of my engines. It is true these are all old devices, and I have often thought my ideas of them must be too settled on account of the great desire shown by so many mechanics to find a substitute for them. The numerous patents issued for devices doing away with them is evidence of this; and they point triumphantly to the fact that "we have no cranks on our pumps, no eccentrics on our engines, nor fly wheels of any account." I grant this, but what have they given us in their stead? Generally a bad substitute for the proper thing; and I would respectfully refer those gentlemen to the study of these devices by Rankine, Riggs, Hoadly and other scientists; after which I think their ideas will be modified. I shall at all events endeavor to show as I proceed with my subject, by diagrams and reason, that they are eminently fitting accompaniments to a good working and economical pumping engine.

[Mr. Martin here gave a description of his engine from a plan and longitudinal section, which appeared in an issue of this journal last October. There are two water cylinders, each having its operative parts independent of the other but both of them connected to one shaft. Both shafts are located transversely on the bed plate of the engines, the steam and water cylinders being longitudinally on the engine bed. Each water cylinder is bolted to the bed plate or girders which form the bed of engines proper; and the steam cylinders are bolted to the water cylinders on top and in longitudinal vertical plane therewith. The driving shaft of steam portion has a crank on each end thereof, the cranks being at right angles to each other. Said shaft carries a fly wheel pinion and eccentrics. The eccentrics operate the valve gear and the pinion (which is usually about one-fourth the diameter of the gear wheel), which works into the wheel mounted on a shaft below, which has also two cranks at right angles to each other. These cranks operate the pumps. Thus while the water pistons are kept running at slow speed, a high rate of speed can be secured in the steam pistons, thereby securing the full benefits accruing from high steam piston speed and moderately high ratios of expansion, while the water piston speed can be reduced to the lowest possible degree.]

All must admit the certain testimony of the indicator, for by this instrument on the water cylinder all the defects of the action of valves, irregular motion of pistons or plungers and the period of stroke at which they occur are clearly shown; in fact, it is a faithful monitor of what is taking place in the cylinder, either water or steam. Of course there are defects to be expected in the operation and even construction of the indicator, which render the measuring of the power of the steam engine somewhat questionable. I refer to the temper and tension of the spring; but the diagram certainly indicates the working value of that particular valve gear and also the economy of the engine from which the figures were taken; and in discussing the water diagrams we will notice only a part of them which I wish to call special attention to.



MARTIN PUMPING ENGINE, NEWBURGH, OHIO.

The figures in the first group are not of my selection but are taken from Mr. Worthington's pamphlet and of course may be accepted as being correct; at all events, I am not responsible for them, other than that I will guarantee them exact copies of his. Of course they are exhibited by him to show that it was not possible either to have a proper closing or opening of the water valves by a crank engine or to maintain a steady pressure on the column of water.

No. 1 was taken from the celebrated Shields engine at Cincinnati and may be considered fairly good in all respects. The speed no doubt was slow on account of the ponderous size of the engine. It was constructed to pump 30,000,000 gallons per 24 hours, I believe; but has never approached that quantity. The steam cylinder is 100 inches in diameter and 12 feet stroke, and was expected to work 100 feet per minute. No. 2 is from a crank engine, also of Cincinnati. This is a remarkable figure. The action is from left to right, and the vibration of the pencil plainly indicates the faulty action of the valves at the commencement of the stroke, and not the irregular motion of piston as Mr. Worthington would lead us to believe. No. 3 is from the same engine; in this, it will be seen the valves close much more quickly, and the pressure line is carried very regularly. I have no hesitation in saying the defects of this pump in regard to irregular figure are the fault of the valves and not of the action of the pistons. No. 4 is from the celebrated Leavitt compound engines of Lynn, Mass., and I consider it the worst figure in the whole exhibit. The action of valves is bad and the motion of pistons was very quick or the motion in steam cylinders very irregular. Nos. 7 and 8 are also crank engines of Chicago, and, I believe, were made by the Allaire Iron Works Co., of New York. The faulty action of the water valves is plainly seen in these figures at both ends of stroke. It is certain to my mind that by proper arrangement of valves many of these defects could be obviated; thereby fully ten per cent. more water would be delivered each stroke, consequently that amount of saving to the city. The evidence of this is shown in the beautiful straight pressure line of No. 8 taken from the same engine as No. 7. After the inlet valves are seated the pressure line is very regular until the closing of discharge valves commences, which are slow to operate. No. 10 is from a Worthington engine at Newark, N. J., and may be said to be very good; and the same may be said of No. 11 from a Worthington engine at Salem, Mass. No. 12 is from the McAlpin engine at New Bedford. Here is another evidence of bad construction of valves, although not so bad as the Chicago engine of the same type. The uncertainty of action of the valves is demonstrated by comparing it with No. 13 from the same engine. This diagram may well be pronounced good, particularly as I have been informed it is a quick-running engine.

The following series of diagrams were all taken from hydraulic pumping engines of the design submitted for your inspection. They are in operation at the Cleveland Rolling Mill Co.'s works at Newburgh, Ohio. They were constructed and built in the company's works and are used in the operation of the numerous hydraulic cranes, hoists, &c., in their extensive works. The pumps were running at a speed of about 90 feet per minute when these figures were taken. They usually pump into an accumulator, in this case loaded to about 200 lbs. per square inch; but in some of them over 400 lbs pressure is used. The speed of the pumps is regulated by the quantity of work done at the cranes, sometimes running at a speed of 150 feet per minute; and even at this speed there is no shock or jar felt at the pumps; although the weighted ram rises and falls very rapidly when several of the cranes are worked at the same time. The engines from which these figures were taken were built in 1879 and have been in work day and night since that time; and with the exception of packing and the occasional changing of a valve have cost nothing for repairs. The valves are simple blocks of wood with metal casings partly to give them weight and partly to prevent wear in the guides which are cast on the covers or bonnets.

In referring to these figures taken from the pumps above alluded to, it will be seen that no loss is perceptible in the operation of the valves; and although the pressure line is not so straight as that of the Worthington, the variation of pressure is quite light and much of this is caused by the motion of the accumulator.

There is nothing novel in the construction or the operation of the steam valve gear; it is simply a half link or sword arm worked by an ec-

Concluded on Page 56.

Manufactures.

CLEVELAND.

WARNER & SWASEY have, during the past year, added several new machines to their list of standard machine tools.

THE Gardner Gun Co. has recently completed a contract with the English Government for a large number of 5-barrel guns, and is abont beginning on another contract with the same Government for 2-barrel guns.

ON taking leave of the employes of the Peck, Stow & Wilcox Co., Cleveland, of which he had long been Superintendent, Mr. P. A. Whitney, now of this place, was presented by them with a set of four machinist's squares, made for them to order and costing over $50.—[Chagrin Falls Exponent.

A SUCCESSFUL test of the new N. Y., P. & O. Railroad ore-hoisting apparatus was made the other day on the company's docks. The system put in is that of the Brown Hoisting and Conveying Machine Co., of this city, and has a capacity, with three buckets for each hatch, of unloading 1,000 tons of ore in ten hours.

AT the Lake Shore Tube Works, orders have been given for the erection of two more lap-weld furnaces, in addition to the lap-weld furnace already there, and one new butt-weld furnace, which will give them three lap-weld and three butt-weld furnaces, making these tube works one of the largest in the country, and the largest west of Pittsburgh.

CORPORATION elections the past week: Republic Iron Co., directors: David Morgan, Marquette, Mich. (President); Joseph Perkins, Cleveland, (Treasurer); Charles Hickox, Cleveland, (Vice President); S. P. Ely, Marquette; G. W. R. Mattison, Providence, R. I.; H. B. Perkins, Warren, O.; W. D. Rees, Cleveland, (Secretary); L. V. Painter, Cleveland; Charles G. Hickox, Cleveland, (Auditor). Union Steel Screw Co., directors: J. H. Wade, H. B. Payne, William Chisholm, L. M. Hubby, S. T. Everett, C. P. Leland, (Vice President), and Fayette Brown, (President). Cleveland Rolling Mill Co., directors: Wm. Chisholm, (President), H. B. Payne, J. H. Wade, S. T. Everett, and S. H. Chisholm, (Vice President).

OHIO.

PARTIES in Toledo are negotiating the purchase of the Smith Plate factory at Delta, valued at $50,000.

THE Winfield Manufacturing Works, of Warren, have received from one firm an order for 5,000 oil cans per month.

THE pottery works at Leetonia have been sold and will be operated by a stock company, who will put in additional machinery.

THE Brier Hill Iron and Coal Company expects to have its steel furnace in operation by April 1. --[Youngstown News-Register.

SUMMERS BROS. & Co., Struthers, have added another box annealing furnace to their finishing department and are now running exclusively on roofing iron.

FIVE hundred new freight cars have been ordered for the Pittsburgh, Cleveland & Toledo Railroad from the Youngstown Car Manufacturing Co., and 500 from the Lima Car Works.

THE Lechner Manufacturing Co., Columbus, have furnished the Northwestern Lumber Co., Porter's Mills, Wis., with roller detachable chain; Spangenburg, Pendleton & Co., Warren, O., and Grocer's Wooden Dish Co., Mt. Carmel, Ill., with chain conveyors. In addition to this they have furnished The Anchor Tannery, Cincinnati, with additional chain belting; Lewis Foundry and Machine Co., limited, Pittsburgh, with detachable chain for racking carriage on lifting cranes; Smethport Extract Co., East Smethport, Pa., with tan bark conveyors and others.

THE Akron Iron Co., (Bar and Pig Iron and Patent Hot Polished Shafting), Akron, write the American Machinist as follows: "Trade for 1883 in our line did not nearly come up to our expectations, but, under the circumstances, we have no great cause of complaint. Our trade in common bar iron is confined almost exclusively to the agricultural implement trade, which suffered during the fall season both from over production, and from the failure of the wheat crop in the winter wheat States. Consequently manufacturers in that line have been running slow up to January 1, but from now till July 1, next ,we look tor an increased demand in that line, in fact orders from this source are now coming in rapidly."

IN GENERAL.

THE Crawford Iron & Steel Co., of New Castle, Pa., has been chartered, with a capital of $1,500,000.

AN effort is being made by capitalists in Sharon, Pa., to secure the location of a tin plate mill.

THE Penn Iron Works of Lancaster, Pa., which suspended operations a week before Christmas, have resumed work at reduced wages.

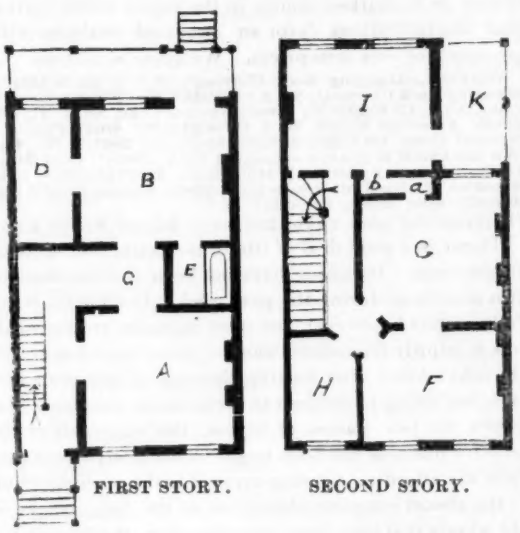
THE charter of the Orvis Smokeless Hydro-Carbon Furnace Co., at Chicago, capital $100,000, was surrendered and canceled, and the company incorporated under the same name with a capital of $1,000,000.

FIVE acres of land and $2,000 in money has been donated by the citizens of Wampum, Pa., to secure the promised location of steel works in that place. The project is in the hands of Pittsburgh capitalists.

A PATENT has been applied for on a natural-gas puddling furnace by William McKenna, of Wilson, Walker & Co.'s mill, Pittsburgh. The furnace is now in use at the mill, does its work well, and uses less gas than any other kind of furnace.

Homes for Mechanics.

We reproduce from the Hardware Reporter, St. Louis, the following exellent plan for a house of moderate cost:



FIRST STORY. SECOND STORY.

A.—Parlor.
B.—Kitchen.
C.—Hall.
D.—Pantry.
E.—Bath.
F.—Bed room.
G.—Bed room.
H.—Bed room.
I. —Bed room.
K.—Porch.
a. } —Closets.
b. }

The estimated cost of this building is $1,700; built of brick, 9 inch walls, furred; well laid yellow pine floors; plastered with the usual three-coat work, and finished with plain finish; for doors and windows, well finished hardware; and first-class plumbing; the sizes of main rooms are 12x12 feet; porch, 14 feet; unfinished cellar, 5 or 6 feet in the clear. The bath is placed next to the kitchen, in the shape of a closet, for the sake of economy to the occupant, the kitchen being nearly always heated. A transom lights the bath, and in connection with the door, it is an easy matter to heat the bath room by leaving the door and transom open, until ready for bath.

Natural Gas for Puddling.

Pittsburgh Telegraph.

The iron workers at Kittanning, Pa., say that in the puddling furnaces natural gas fuel meets every want. Any degree of temperature needed can be obtained and kept at a fixed hight. Atmospheric burners are used, by which the proportions of air and gas can be so regulated as to give the greatest or least amount of heat. The aperture through which the gas is conveyed into the burner is never more than one eighth of an inch in diameter, and the mixed proportions of air and gas enter an iron tube about two inches in diameter and perforated with small holes, through which the gas escapes and burns. This iron tube is placed in furnaces, heaters, stoves and grates, where the effects of the best heat are produced with little trouble.

METALS AND THEIR PROPERTIES.

As to Fracture, Ductility, Tenacity, Lustrs, etc.

BY ARCHIBALD M'KILLUP.*

(Mining Engineer of the Central Ohio Coal Co.)

It is usual to divide all elementary substances into metals and metalloids or non-metals. This division is not a very clear one, and it would be difficult to draw a strict line of demarcation between the two kinds of bodies. A metal is usually defined as an elementary substance possessing power of conducting heat and electricity, opacity and peculiar metallic lustre. These three properties are usually the marks of metallic bodies. Taking the third property first, i. e., peculiar metallic lustre, we find that this lustre in not confined to metals. If we look merely to lustre, it would be difficult to exclude graphite carbon, crystalline silicon, etc., from the list of metals. Arsenic is seen in the form of a mirror and possesses metallic lustre, but in its chemical deportment it is very like phosphorus, and phosphorus is by general consent considered non-metallic; and if we lose sight of the metallic lustre which arsenic possesses, and look to its more stable and unchangeable properties, we should at once call it non-metallic. The property of lustre is sometimes lost when a solution of auric chloride is tested with ferrous sulphate; the metallic gold is got in a different condition from that in which we ordinarily see it. If we filter the product, we obtain gold as a powder, void of metallic lustre; but if this powder is dried, and rubbed with a pestle, the gold will acquire its metallic lustre again. Metallic lustre depends upon the molecular arrangement of the metal.

Carbon is found in nature in two allotropic forms which possess lustre, the diamond and graphite. But it is also found in forms possessing no lustre, and these different forms of carbon vary in their power of conducting heat and electricity; ordinarily it is an indifferent conductor—heated, it is a good conductor, a feature that enables us to make use of carbon points in the voltaic arc.

Metals only possess the power of conducting heat and electricity when they are in compact form. Hence in the case of those rarer metals that have never solidified and those that exist only as a powder, this property is unknown. The power of conducting electricity varies in metals with the temperature, the power of conduction growing less as the temperature rises. Upon this law Siemens has invented the pyrometer. In passing from one degree of temperature to another, some metals assume a pasty or adhesive form. This condition has been found extremely useful, and it is owing to this property that iron can be so easily welded. Although silver has the greatest electricity-conducting power, copper is the metal used, because of its cheapness. The smallest trace of impurities lessens the conducting power of metals. It is at present a field of research—the action of small quantities of one metal upon large quantities of others. Why traces of impurities affect metals as they do is a point not yet thoroughly understood.

Opacity varies with the thickness of the metal. Gold may be beaten out so thin that a considerable amount of light of a green color will pass through it.

In chemical work, the changes that bodies undergo are of two kinds: physical and chemical. The former changes are too often overlooked; the attention cannot be too strongly directed to them. The physical properties, such as crystalline structure, color, hardness, etc., and physical changes should be very carefully noted.

Certain metals have a distinct color. Most of them have a more or less deep gray color. This gray approaches more nearly to white with polishing. Soms metals are white, as silver, platinum and magnesium. Zinc and lead are bluish; calcium, a pale yellow; copper and bismuth, reddish; and gold a bright yellow.

[To be continued.]

* Read before the Ohio Institute of Mining Engineers, at Columbus, January 9, 1884.

One of the best advertising mediums—the IRON TRADE REVIEW AND WESTERN MACHINIST.

Market Review.

OFFICE OF IRON TRADE REVIEW.
CLEVELAND, FRIDAY EVENING, Jan 25, 1884.

IRON ORE.

We hear numerous rumors of extensive sales, but none of moment have yet taken place in this market. Orders have, however, come in for larger quantities than heretofore, several lots of 500 to 1,000 tons having changed hands. Apparently well authenticated reports are in circulation that upwards of 300,000 tons have been placed with Chicago and Joliet parties, about half Menominee and half Marquette ores. Another report is that 75,000 tons of Pilot Knob ore, from Missouri, have also been sold in Chicago. Of the sale of at least 50,000 tons of Menominee Range ores we have positive assurance. These sales have no doubt been made at buyers' advantage, but they also indicate returning confidence on the part of furnacemen—a hopeful sign for the future. The question of prices for the coming year has been discussed by some dealers, but as yet no definite figures have been announced. The general impression is that they will open up about as they closed in 1883, though there may be a slight variation in some mines, while in those that sold low last year there will be no change. The total shipments from Cleveland the past week have been 7,909 tons. We quote:

No. 1 Specular and magnetic Bessemer Ores per ton	$6.50@ 7.00
No. 1 Specular (non-Bessemer) ores per ton	6.00@ 6 25
Bessemer Hematites	5.00@ 5.25
Non-Bessemer Hematites	4.75@ 5.25
Menominee Range Bessemer	6.00
Menominee Range non-Bessemer	4.75@ 5.00

PIG IRON.

A very large amount of pig iron has been sold in this market since New Year's, several individual sales of considerable magnitude having taken place. There is a very general feeling that bottom has been reached and that the next change will be for better prices. By diligent inquiry we learn that the following is an approximate estimate of the present condition of furnaces in the Cleveland, Mahoning and Shenango districts:

Where located.	In blast.	Out of blast.
Cleveland	2	4
Mahoning Valley	6	11
Shenango Valley	9	14
Total	17	29

Local receipts of pig iron the past week have been 867 tons; shipments, 79 tons. We quote:

CHARCOAL PIG IRON.

No. 1 Lake Superior charcoal	$23.00@25.00
No. 2 Lake Superior charcoal	23.00@25.00
Nos. 3 and 4 Lake Superior	21.00@25.00
Nos. 5 and 6 Lake Superior	23.00@25.00
Nos. 1 2, 3. 4, 5, Salisbury	35.00@37.00
Southern Car Wheel	28.00@33.00

BITUMINOUS AND COKE IRON.

No. 1 foundry, all lake ores	$21.00@22.00
No. 2 same	20.00@21.00
No. 1 foundry, lake ores, with cinder mixture	20.00@21.00
No. 2 same	19.00@20.50
No. 1 foundry, native Ohio ores	21.00@22.00
No. 2 same	19.00@20.50
No. 1 silvery, native Ohio ores	21.00@22 00
No. 2 same	18.00@20.00
No. 1 gray forge, red short	18.50@19.50
No 1 gray forge, neutral	17.50@18.50
No. 1 Bessemer	21.00@22.00

STEEL RAILS.

Orders for about 25,000 tons of steel rails have been taken in this city during the past six weeks. We learn that prices in the West are stiffer; that orders thus far booked range from $37 to $39, and that offers by Eastern mills to unload orders in the West at $35 have been refused. It is now the belief that more miles of railroad will be built this year than predicted.

MANUFACTURED IRON.

A fair indication of the continued improvement in trade is shown by the statement of a prominent Youngstown dealer in this city, that trade has been better this month than for the same period a year ago. Stocks are low and inquiries are increasing, with the object of sorting up stocks. It looks now as if the belief is general that bottom has been reached and that better prices will be the rule and not exception.

Receipts of bar iron the past week have been 962 tons; shipments, 331 tons.

WROUGHT PIPE—Prices are firm, although business this month will, it is claimed, average worse than for the same period during the past 13 years. The cold weather has seriously impeded the movement of stocks; yet there is a confident feeling that prices are at the bottom. Although stocks are not large, it is impossible to reduce them this kind of weather.

SCRAP IRON.

We hear of no improvement to note yet in the scrap iron trade. Sales are small, and no change for the better is expected before the middle of next month.

Receipts of scrap iron the past week have been 121 tons; shipments, 331 tons.

HARDWARE.

A considerable improvement is to be noted over last week. Country merchants are beginning to sort up stocks, and jobbers expect a steady increase in business from now on. Numerous changes in discounts have taken place since the opening of the year, our hardware quotations having been extensively remodeled and enlarged this week. From the Union Steel Screw Co. we have received the following circular:

"Hereby cancelling our circular quotations of July 11, 1883, we quote the following discounts and terms for Wood Screws of our manufacture.

List of December 27, 1882.

Flat Head Steel,	70 per cent.
Round Head Steel,	65 "
Flat Head Brass,	70 "
Round Head Brass,	60 "

Terms Cash. No prices guaranteed. Soliciting your favors, which shall have our best attention, we are, Yours respectfully, UNION STEEL SCREW COMPANY."

NAILS—The nail market is quiet but firm. The strike of the Eastern nail-makers has not as yet affected the local market. Receipts the past week have been 561 kegs; shipments, 962 kegs.

COAL.

Prices are unchanged, and the market continues steady. The mines of this district are all working quite regularly. Receipts of bituminous coal at Cleveland have been quite heavy the past week, 27,760 tons. Receipts of anthracite have been 1,219 tons.

CINCINNATI PIG IRON MARKET.

[Reported for IRON TRADE REVIEW by E. L. Harper & Co.]

The business the past week has been quite large in volume, though prices continue about the same as quoted last week. Some of the furnaces will not duplicate orders entered a few weeks since, and in some instances an advance price has beeu accepted by buyers. There is no marked change in the aspect of the market and the indications favor an increased business with prospects of very firm prices. We quote as follows:

FOUNDRY.—Hanging Rock Charcoal, No 1, $22 50@$23 50; Hanging Rock Charcoal, No. 2, $21 25@$22 25: Strong Neutral Coke, No. 1, $19 00@$20 00; Strong Neutral Coke, No. 2, $18 00@$19 00; American Scotch, No. 1, $18 00@$19 00. GREY FORGE.—Neutral Coke, $16 75@$17 25. Cold Short, $16 25@$16 75; CAR WHEEL AND MALLEABLE—Hanging Rock, Strictly Cold Blast, $27 75; Hanging Rock Warm Blast, $24 00@$24 50; Lake Superior, Charcoal all grades $24 00@25 00; Southern Car Wheel Strictly Cold Blast, $26 50@$27 50.

[Reported for IRON TRADE REVIEW by Rogers, Brown & Co.]

There is a good deal of life in the market, in spite of forebodings. Inquiries have not been so numerous for two months as during the past week. Confidence is not fully restored, however, and most inquiries are for small lots to supply immediate wants. Some large buyers, on the other hand, after looking thoroughly into the situation, are trying to contract as far ahead as possible. Between the two classes of buyers, the aggregate of the month's business has been large. Two newly developed facts are affording a strong support to the market. One is the almost complete absorption of the large blocks of old wheels that have been pressing upon the market for some months at St. Louis, Chicago, Detroit and Fort Wayne. Another is the very heavy advance orders placed with rail mills and the cousequent stiffening in the prices of steel rails. Car wheel irons are moving well and charcoal foundry grades are in better demand. No change in prices has occurred and we quote for cash:

Hot Blast Foundry.—Hanging Rock Charcoal, No. 1, $22 50@$23 50; Hanging Rock Charcoal, No. 2, $20 00@22 00; Southern Charcoal, No. 1, $21 00@$22 00; Strong Coke, No. 1, $19 00@19 50; Strong Coke, No. 2, $17 50@$18 50; Strong Coke No. 3, $17 00@$18 00; Soft Stone Coal, No. 1, $19 00@$20 00; Soft Stone Coal, No. 2, $17 50@$18 50. Forge—Strong Neutral No. 1, mill 16 00@$16 50; Cold Short No. 1 mill, $15 50@$16 00. Car Wheel Malleable—Hanging Rock Cold Blast $30 00@$31 00; Hanging Rock Warm Blast $23 00@$26 00; Southern Car Wheel Iron $25 50@$26 50; Lake Superior Car Wheel Iron, $24 50@$25 50; Lake Superior Malleable Iron, $24 50@$25 50.

CHICAGO PIG IRON MARKET.

[Reported for IRON TRADE REVIEW by Pickands, Brown & Co.]

There is a fair demand for small lots and but little inquiry for large ones. We quote today (Jan. 22):

Nos. 1 & 2 Lake Superior Charcoal, $23 00@$23 50; No. 3 Lake Superior for Car Wheels, $23 00@$23 50; Nos. 4 and 5 Lake Superior for Car Wheels, $24 00@$25 00; No. 1 Scotch, according to brand, $27 00@$28 00; No. 1 Hanging Rock, Charcoal, $26 00@$27 00; No. 1 Hanging Rock Coke, $23 00@$24 00; No. 1 Anthracite, $22 00@$23 00; No. 2 Anthracite, $21 00@$22 00; No. 1 American Scotch, $21 00@$23 00.

PITTSBURGH PIG IRON MARKET.

[Reported for IRON TRADE REVIEW by A. H. Childs, 83 4th ave.

There is a somewhat better feeling in the market and pig iron is firmly held at ruling prices for immediate delivery. Quotations are:

No. 1 Foundry, $19 00@20 00, 4 mos.; No. 2 Foundry, $18 00@19 00, 4 mos.; Gray Forge, $17 25@18 00, 4 mos.; White and Mottled, $16 00@17 50, 4 mos; Warm Blast Charcoal, $22 00@28 00, mos.; Cold Blast Charcoal, $24 00@30 00, 4 mos.

LOUISVILLE PIG IRON MARKET.

Reported for the IRON TRADE REVIEW by Geo. H. Hull & Co.

The market is quiet and very firm in prices. There are considerably many buyers in the market at their figures, slightly under market prices; but furnaces are firm and decline all such offers, and sales in consequence are restricted.

FOUNDRY IRON.—Hanging Rock Charcoal, No. 1, $23.25@$24.25; Southern Charcoal, No. 1, $21.00@$22.00; Hanging Rock Stone-coal and Coke, No. 1, $20 00@$20.50; Southern Stone-coal and Coke, No. 1, $19.00@$19.50; Southern Stone-coal and Coke, No. 2, $18.00@$18.50; "American Scotch," $18.00@$19.00; Open Silver Gray, $17.50@$18.00; Close Silver Gray, $16.50@$17.00 MILL-IRONS.—No. 1, Charcoal, $19.00@$20.00; No. 1, Stone coal and Coke, Neutral, $16.50@$17.00; No. 2, Stone-coal and Coke, Neutral, $16.00@$16.50; No. 1, Stone-coal and Coke, Cold Short, $16.00@$16.50; No. 2, Stone coal and Coke, Cold Short, $15.50 @$16.00; White and Mottled, Cold Short and Neutral, $14.50@$15.00. CAR-WHEEL IRONS.—Hanging Rock, Cold Blast,, $30 00@$31.00; Hanging Rock, Warm Blast, $23.00@$24.00; Alabama and Georgia, Warm and Cold Blast, $23.00@$28.00; Central Kentucky, Cold Blast, $25.00@$26.00.

THE PUMPING ENGINE OF THE PERIOD.

Concluded from Page 54

centric; and the valves are of the common semi-rotative or Corliss type; the ports of the cut off are generally double, so that the closing may be as quick as possible, and to what extent this is accomplished is shown by the figures here exhibited. The double figures are taken from both ends of the same cylinder and are cutting off at about one fifth stroke. This is as close as can be used at this spesd without the aid of a condenser or larger fly-wheel. Of course the speed could be increased under more favorable circumstances almost double. I have previously said that the indicator diagram truthfully taken, as compared with the standard or theoretical figure, indicates the value of that particular valve gear and also the economy of the engine from which it was taken. Of course the form of figure can be changed at will by adjustment of eccentric or other operating device; but by changing the form we also change the value, and the greatest useful effect will be obtained when the figure is nearest the theoretical or standard in all respects and may be summed up thus: The admission line should be at right angles to the atmospheric line; the initial pressure should correspond as near as possible to boiler pressure; the steam line should be straight and parallel with the atmospheric line with sharp cut-off point, low terminal pressure and no back pressure, up to the point where compression commences. How near these figures approach that standard I leave you to judge.

It is not a part of this paper to discuss the question theoretically as to the most economical point of cut-off in this type of engine, nor as to whether expansion can be carried further by compounding than non-compounding, with the most economical results. Good reason and a great quantity of facts have been produced by the advocates of each side of the question, both claiming supremacy; as yet theoretically it has not been clearly settled in my opinion; but under special conditions which may favor one more than the other, better results may be obtained, thus proving that the pumping engine of the period (or any other engine for that part) is the pumping engine which the period requires, and the engine which the period requires is that engine (other good qualities of course being equal) which shall perform the highest duty with the same current expense. In order to prove this superiority no theories, no matter how elaborate or clear they may appear, will be accepted, unless checked and verified by actual experiment; and the merits and demerits of these experiments are sure to be manifest in the qualities of the indicator diagrams.

I have prepared some mathematical computations of these figures in relation to the duty being performed by these engines as shown by the measurement of these diagrams and have sent them to New York to get them verified by expert authorities before having them published; which I intend doing, because these diagrams, in my opinion, represent two distinct orders of facts. In the first place, the steam figures, measured alone, represent the indicated power; but measured in connection with the water diagrams, they represent the net power of the engines, because the measure of the water diagrams is just the same as though we were measuring the power of the engines by the brake, and estimated at an evaporation of 7½ to 1 we get 82,000,000 foot pounds duty from these figures.

In conclusion, I will briefly say that in the matter of refinement in construction, *i.e.*, devices for the operation of steam valves, clearance at ends of cylinders, &c., are matters requiring skill and thought, and ought not to be lightly treated when considering economy; but there is little hope for ingenious dodges as substitutes for plain, simple devices which, after all, only accomplish the same ends at much greater risk of operation on account of complication.

Cleveland Wholesale Prices.

[The lowest quotable prices are given in all cases.]

HARDWARE.

Adzes.

Carpenter's.....per doz $18 40
Ship..... " " 18 75
Heavy railroad.. " " 19 50

Axes.

per doz.
James' 2d qual..... $7 00
Buckeye..... 7 75
" doub. bitt..... 15 00
Hunt's..... 9 50
Mami's..... 8 00
Lippincott's Crown..... 8 50
Cut More..... 9 00
Peck's Double Bit..... 22 00
"Champion Blade..... 11 00
Good triple silver steel.. 11 50

Axles.

Standard list,....
Nos. 1 to 6, 50 & 10 off
Nos. 7 to 14, 50 & 5 off
Nos. 15 to 18, 45 off
Nos. 19 to 22, 50 & 5 off

Anvils.

per lb.
Eagle, Amer.....10c dis 20
Wright's.....10¾c@11c
Armitage's Mouse Hole.....9½c@9¾c
Trenton..... 10½c
Wilkinson's..... 10¾c

Anvil Vise and Drill.

Millers Falls Co. $18. ...dis 20
Cheney Anvil and Vise dis25&2

Augurs and Bits.

C S cut augers .....dis 60
do do do bits.....60
D C gimlet do Ives.. dis 50
Snells bits.....dis 60
Russell Jennings' augers, new list dis 25
Cook's pat augur.....40&10

Animal Pokes.

Akron.....$ 3 50
Camp's..... 4 00
Berea, per doz..... 4 00
Eagle, per doz..... 5 00

Apple Parers.

Domestic&Reading ℔ doz.$7 00
Turn Table..... 4 50

Axle Grease.

Frazier's, per gross,.....$10 00
Common, " 6 00

Bolts.

Carriage com, old list...80&20
Tire, common, old list...80&20
Eagle carriage bolts 70
Philadel. " " 75
Stove bolts.....50
Plow bolts.....40
Machine..... 75
Cast iron barrel bolts . } 55&10
Wr't " " " . }
Cast iron chain bolts.. } 65&10
Wr't iron sq'r bolts.... } 55&10
Wr't shutter bolts..... } 55&10
Ives' pat. door bolts.... 50
Sargent's list
Bolt Ends 16c. per lb. net... 75
Cast Iron Barrel Shutter, etc .....dis 55&10
Wrought Barrel.....dis 55&10
Wrought Square.....dis 55&10
Wr'g't Shut'r, all iron, Stanley's list.....dis 50&10

Bright Wire Goods.

List June 5th, 1883.....70&10

Bellows.

Dis
Hill,s .....40 pr cent
Bl'ksmith's com new list,50℔ct
Moulder's new list, dis 25 ℔ ct
Hand, new list, 25 per cent

Butts.

Dis
Wrought brass..... 75
Cast, loose joint.... 60&10
Pin, loose..... 60&10
Wrought, fast joint narrow..... 60
Wrought fast joint broad..... 60
Wrought loose joint broad..... 60
Wrought table and back flaps..... 60
Loose joint, without acorns..... 60
2 per ct. extra dis for cash.

Boiler Plates.

"Gaylord"-Standard Quality.
C. No. 1.....4 50
C. H. No. 1 Shell.....4 75
C. H. No. 1, 50,000.....5 25
C. H. No. 1, 55,000.....5 75
C. H. No. 1 Flange.....6 50
Firebox.....
T. S., 60,000 .....(as per)..6 50
T. S., 65,000 .....(act of)...
Homo. Steel, 70,000 (of Cong)7 50
Heads, ½c ℔ lb. extra.
N.B.-Eastern brands of boiler plate at from 2-10 to 3-10c ℔ lb less than above prices.

Boiler Tubes.

"National" Standard Gauge 1 inch to 10 inch.....dis 37½
"National" Standard Gauge 11 inch to 15 inch ... dis 25
"National" Special Locomotive Tubes. ....net list

BoilerMakers' Tools.

Doty's Power Shears ..net list
" Hand Lever Shears.net list
" Power Punch.....net list
" Hand Punch.....net list
Steel Screw Punch.....net list
Iron Screw Punch ....net list
Boiler Plate Rolls.....net list
Buffalo Forges&Blowers dis 20
Watson's " " net list
Spring Tube Expander ..dis 15
Roller Tube Expander.net list
National Tube Cleaner .dis 20
Wire Flue Brushes ....net list
Anvils—'PeterWright' 12½℔lb
Solid Box Vises..... net list

Bag Holders.

Sprengle's Pat, $18.00 per doz 40 per cent. dis.

Cleveland Stamped Elbows

Genuine Russia Iron

4½inch, per doz		5 50
5 do	do	7 50
6 do	do	9 50
7 do	do	11 00

Charcoal Iron

4½inch, per doz		2 50
5 do	do	3 50
6 do	do	4 50
7 do	do	5 50

Planished Amer. Russia Iron

4½inch per doz		5 00
5 do	do	6 50
6 do	do	8 50
7 do	do	9 50

Discount 33⅓ per cent

Chisels.

Cast steel ..... ℔ lb 5
Iron,steel points..... 4½

Cutlery, Pocket and Table.

Meriden Cutlery Co., table net
Am. Miller Bros.' Cutlery Co .....dis 25
Humason & Beckley, pocket 33⅓
Naugatuck Cutlery Co.list net
Aaron Berkenshaw's pocket dis 25
Fram Cutlery Co., table net
Cleveland Cutlery Co...dis 25
Miller Bros., pocket.... 33⅓
Akron Cutlery Co.....dss 45

Coopers' Tools.

Bradley's ..... dis15@20
Braton's ..... dis15@20

Chains.

Coil by cask,.....

3-16	¼	5-16	⅜	7-16	½
9	7½	6 15	560	5 10	495

Drills and Drill Stocks.

Blacksmiths', each $2.50 dis 10
Blacksmiths', self-feeding, each 7.50 dis 20
Breast, P. S. & W ...dis 20&10

Drawing Knives.

Peck, Stow & Wilcox... dis 70
Witherby's .....dis 65@10
Nobles Mfgr. Co 15
Adjustable handle 20

Emery and Sand Paper.

Regular Numbers .....℔ lb 6c
Flour and F. F.....℔ lb 4c
B. & A. Emery Paper ...dis 35
Sand paper .....dis 35

Enameled & Tinned Ware.

Kettles.....dis 50
Sauce Pans.....dis 30
Tinned Sauce Pans..... dis 30

Files.

Parkin's $5 to £..dis 45 ℔ cent
E.M. Boynton's, new list dis 25
J. & Riley Carr .....4.50 to £.
Johnson & Bro. .....dis 50
Butcher's.....4.50 to £.
Walter Spencer & Co.'s "Diamond".....4.50 to £.
Westerh 40
H. Disston & Sons (new list)..... dis 40 per cent
Heller Bros.' Horse Rasps dis 35
Nicholson..... dis 40
New American..... dis 40
Union File Co ..... dis 40
Dayton File Works 40

Grindstones.

Berea.....1@1¼ ℔ lb
Ohio.....1¼@1½ ℔lb
Nova Scotia.....1¼@1¾ ℔lb
Lake Huron.....1@1¼ ℔ lb

Hammers.

Maydole's ..... dis 15
Cheney's .....new list 20&50
Hartford Hammer Co....dis 20
Humason & Beckley.....dis 15
Verree..... dis 5
Magnetic Tack, Nos. 1, 2, 3, $1.25, $1.50 and $1.75,dis25&10
Nelson Tool Works..dis 40&10
Warner & Noble's .....dis 5
Kip's.....dis 30

Hatchets.

Buckeye.....Shingling,
Nos...1, 2, 3,
℔ doz $7 50,$8 00,$8 50,dis 40
Claw,
Nos...1, 2, 3,
℔ doz$8 25,$8 75,$9 25, dis 40
Lathing,
Nos.....1, 2, 3,
℔doz $7 50.$8 00,$8 50, dis 40

Hay Knives.

Lightning .....per doz. net $18
Wadsworth 33⅓

Hinges.

Champion double acting spring hinges .....dis. 30
Screw & Strap 6@12in..... 4c
" " 14 in. & larger 3c
Gravity Locking Blind Hinges, Sargeant & Co. 70&10
Clark & Co .....70&10
Strap and T Hinges.....60&10

Locks.

Whipple Mfg Co 60
Norwalk Lo Co 60

Nails.

10 to 60d $2 60
8 and 9d 25
6 and 7d..... 50
4 and 5d 75
3d 1 50
2d 2 75
3d fine 3 00
2d fine 3 75
¾ inch 3 00
4d barrel 1 00
1¼ inch barrel nails..... 1 50
1½ do do do 1 75
1 do do do 2 50
¾ do do do 3 00
Cut spikes, all sizes..... 35
Clinch nails, all sizes..... 1 75
Casing and box nails..... 75
Finishing nails,.....$1 25
Tobacco nails. 50

Nuts and Washers

Nuts,square ..... 8c off list.
Nuts, hexagon.....9c. off list.
Washers.....7c off list.

Nuts, Bolts, etc.

Machine Bolts .....dis 75
Bolt Ends .....dis 75
Boiler Patch Bolts.....net list

Picks.

Railroad, 4 to 5 lbs.. doz $6 60
5 to 6 lbs.. 7 20
to 7 lbs.. 7 80
7 to 8 lbs.. 8 40
Railroad Tamping Pick.. 7 to 8 lbs..doz 10 80
Mill Picks per lb..... 75c

Planes.

Ohio Tool Co .....dis 20
Sciota .....dis 25
Bailey's Pat. Adjstbledis 20@10
Sandusky, fancy .....dis 15
Buckeye .....dis 20
Ogontz .....dis 25

Plumbers', Steam and Gas Fitters' Supplies.

Wrought Iron Pipe now list and dis .....
Gas Pipe--
New List ⅛ to 1¼ black 25 dis
galv'd 15 dis
1½ and larger black.....45 dis
galv'd 30 dis
Malleable Iron Fittings.... 20
Grey Iron Fittings ....dis 50
Steam Brass Goods.....dis 55
Water " " .....dis 50
Ludlow Gate Valves ...dis. 20
Register Gauge Cocks net 1 00
Montg'ry Gauge Cocks $1 each
Steam Gauges .....dis. 40
Steam Guages 5 in. net dial per doz..... 30 00
Scotch Glass Tubes.....dis. 70
Tools..... special.
Duplex Injectors..... net.
Soil Pipe & Fittings, Mott's List.....dis. 30
Sinks, Mott's List.....dis. 25
Copper Bath tubs, sinks, etc.....dis. 25
Galvanized Iron Boilers "Scaifes."..... dis. 50
Marble Slabs, Counter-sunk net per ft.....$ 1 25

Tinners' Tools & Machines.

Machines(P.S.&W.) ... less 10
Tools (P. S. & W.) ..... " 20

Rivets.

Iron .....dis 45
Tinned.....dis 45
Copper .....dis 40 & 10

Rules.

Stanley..... ....dis. 70 & 10

Shovels and Spades.

Ames' new list, July 1, 1881, ...dis 15
Old Colony.....dis 15
Remington's (Lowman's Patent).....dis 30
Bishop .....dis 50
Chisholm.....dis 25@30
Rowland's .....dis 50
Griffiths .....dis 50

Screws.

Dis
Flat head iron or steel [new list] per cent dis. 75
Flat head brass 75
Round head iron or steel 65
Round head brass..... 60
Brass and Silver capped. 40
Japanned, list of Plain Screws.....40&10
Coach, patent Gimlet point, list per 100 70
Lag, taper points..... 70
Bed 10
Machine, flat head, iron. 55
round head, iron 50
Bench, iron ..... 55&10
wood, beech, per doz $3..... 10
wood, hickory .....20&10

Saws.

Disston .....dis 20
Disston's Circular .....dis 40
Disston's hand panel, rip, &c.....dis 20
Boynton's lightning cross cut new list .....dis 40
Boynton's circular and mill.....dis 40
Boynton's ice.....dis 25
Boynton's lightning hand panel and rip .....dis 25
Livingston's butcher and kitchen.....dis 20
Livingston's framed wood Nos. 101 102 and 104 105 doz $10 8.50 10 7.50 6.20 net
Peace circular & mill...dis 40
Peace hand panel and rip .....dis 25
Peace band saws, all widths.....dis 10

Scales.

Hatch, Counter, No. 171....
℔ doz. $42, dis 45
Union Platform.....$6, dis 45
Fairbanks' ..... dis 25
Buffalo Scale Co..... dis 40
Forsyth Scale Co.....dis 30
Howe's.....dis 20&10
Chatlilon's Eureka.....dis 25
Family Universal.....dis 50
Scale Beams.....dis 40&10

Sheet and Tank Rivets.

"Norway."

All sizes.....dis. 15

Boiler Rivets—"Albany."

⅛,¼,11-16,and ⅝ in. diam.4 00
"Standard" ⅛, ¼, 11 16 and ⅝ inch diameter. 4 00

Sad Irons.

From 4 to 10 lbs.. per lb 3 net
Self-Heating.....℔ doz $9 net
" Tailors..℔ doz $18 net
Gleason's Shield and Toilet .....dis 25
Mrs. Pott's Irons, double pointed.....dis 35
Mrs. Pott'sIrons, square back.....dis 25
Enterprise Star Irons....dis 25
Combined Fluter and Sad Iron.....℔ doz $15, dis 15

Squares.

D.s
Steel or iron, case lots.....50
Try squares and T bevels....40

Spikes—WROUGHT

All lengths by ¼ inch .....4 c
do do do 5-16 ..... 3½
do do do ⅜, 7-16 & ½in 3

Tacks, Brads, &c.

New List Sept. 1, 1883.
Tinned Swedes tacks....dis 30
" American " 30
Swedes tacks, all kinds ... 30
American cut tacks..... 30
Copper tacks and nails.... 30
Swedes Hungarian nails.. 35
Gimp and lace tacks..... 30
" " " tin'd. 30
Furnishing nails 25
Trunk and clout nails..... 25
Common and pat. brads... 20
Basket nails..... 20
Brush tacks..... 20
Leathered carpet tacks ... 20
Cigar box nails..... 20
Chair nails 20
Double pointed tacks 40
Extra 10 per cent. on all the above.

Valves.

Dis.
Jenkins' Patent Gate Valves.35
" " Globe ..40
" Standard Packing " ..20

Vises.

Solid box .....45&50
Solid "Crown" (A. H. Hildick)....40 to 100 lb. 15c net
Solid, Peter Wright's 15½
Solid, Wilkinson's..... 14&15
Parallel, Parker's..... dis 25
" Simpson ..... dis 20
" Prentiss..... dis 15

Saw Filers, Hopkins'

℔ doz $17.50, dis 10
" Wentworth's .. 9 00

Cowell Hand Vises.....dis 20

Richardson's Vise and Anvil.....dis 25

Wrenches.

Coe's genuine..... 50
Girard Standard....dis 50 & 10
Mechanics' 10 and 10....dis. 50
P. S. & W. Mechanics dis 50&10
Agricultural .....dis 70
Campfield & Suthff
Engineer's..... 50
Mechanics' 60
Agricultural 70

Wringers.

2½ inches Universal.....$ 6 00
2 inches Eureka..... 36 00

Wire.

Brass and Copper.....dis 30
Bright & annealed, Nos. 0 @ 18 dis 65@67½
" " Nos. 19 @ 26 dis 67½
" Nos. 27 @ 36 dis 70
Coppered Nos.0@18, dis 55@60
Galvanized, Nos. @18,market list,..... dis 50@52½
Tinned, Nos. 0 @ 18,dis 50@52½
Cast steel.....dis 55
Tinned Broom Wire, Nos. 18@20.....8c lb. net
22 to 22 .....8½c lb net
Annealed Fence, Nos. 8 and 9..... dis 65&5
Annealed Grape, Nos. 10 to 14..... dis 65&5
Galvanized Telegraph, Nos. 7 to 9 .....6½c lb net
Galvanized Telegraph, Nos 10 to 11.....℔ lb 7½c
Galvanized Telegraph, No. 12.....℔ lb 7½c
Fence staples. ℔ lb 5½@5¾c
Fence Staples, galvanized, ℔lb 6½@6¾c
Stubs Steel Wire regular 75 per lb net
Barb Wire, painted 5c
Barb Wire, galvanized .. 6c
Roebling's Iron and Steel Wire Rope (Roebling List)..... .....dis 15

TINNER'S STOCK.

Tin.

Banca.....per lb. 22¾
Straits ..... " 21¾c
English ..... " 21½c
Bar ..... " 24c

Tin Plate.

IC 12x12 charcoal .....$ 6 65
IC 14x20 do 6 35
IX 14x20 do 8 00
DC 12½x17 do 7 00
DX 12½x17 do 9 00
DXX, 12½x17 do 11 00
DXXX, 12½x17 do..... 13 00
IC, 20x28 do 13 50
IX, 20x28 do 17 00
IC, 14x20, Best Roof..... 6 00
IX, 14x20, do 7 65
IC, 20x28 do 12 00
IX, 20x28 do 15 50
IC, 10x15 Best Coke..... 5 85
Subject to card discount.

Solder.

Half and Half, in bars....14½
No. 1 do 13½
Spelter Solder.....25

Pat Planished Sheet Iron

[A] ..... per lb 10½c
[B]..... " 9c

Nos	10 to 14	15 to 20	21 to 24 & 26
Com	3-10	3-30	3-40 3-75
Char	5-60	5-60	6-00 6-20

Sheets over 28 in. wide ¼c extra.

Zinc.

Sheet, cask..... 6¼c
Sheet, open..... ..... 6¾c

BRASS.

Cash prices for Roll and Sheet Brass. For less quantity than 100 lbs. add 3c per lb.

High Bra.

All Nos not thinner than 16 No. 28, wider than 2 in. not wider than 14 inch 30c
All Nos to No. 28 inclusive, and widths over 14 to 20 in. inclusive 35c
All Nos to No. 28, inclusive, and widths over 20 to 30 in. inclusive 38
¼c per lb advance on each No above Nos 28 to 38, inclusive.
All Brass thinner than No. 38 is Platers' Brass at 53c
Sheets 24x48, and all sheets cut to particular sizes and lengths under 30 inches, in width wider than 2 inches 37c

Low Brass.

4c pr lb. more than High Brass
Gilding metal 8c per lb, more than High Brass.
Platers' or Gold Metal
In Bars 48c
Sawed 51c
Planed or Polished...54c

For Slitting.

Metal in width in. to ¼ in. to No. 28, inclusive, 1c per lb., advance.
Metal, in width 2 in. to 1 in. thinner than No 28, 2c per lb. advance
Metal, in width ¼ in to ½ in. thinner than No 28, 5cper lb. advance.
Metal ¼ in. in width and less, 10c per lb. advance.
Any of the above widths cut to particular lengths add 7c per pound.
sheathing Brazier Copper, Bolts, etc.
All sizes, 16 oz. per sq. foot. and over. per b 22c
nd over per lb.....22c
Brazier's Copper, ordinary sizes, under 16 oz. and over 12 oz. per sq. foot, per lb. 22c
Brazier's Copper, 10 oz. and 12 oz. per sq. ft...per lb. 24c
Brazier's Copper lighter than 10 oz. per sq. ft...per lb. 32c
Circles less than 84 inches in diameter .... per lb. 33c
Circles 84 inches in diameter and over .....per lb. 30c
Segment and Pattern sheets per lb. 33c
Locomotive Fire Box sheets per lb. 30c
Sheathing Copper, over 12 oz. per sq. ft... per lb. 24c
Bolt Copper.....per lb. 28c
Copper Bottoms per lb. 24c
No copper is Sheathing except 14x10 inches, and not to exceed 34 oz. to the sq. ft.

Tinning.

14x48 .....per sheet 6c
All other size sheets, 2½c per square foot. For tinning both sides, double the above amount.

LEAD.

Amerc'n, ℔ lb..... 4½c
Bar, ℔lb 5½c
Pipe, ℔lb 6¾c dis 10 per ct
Sheet, ℔n 7¼c dis 10 per ct
Tin-lined pipe 15c dis 10 per ct
Block ..... 45c.
Chilled Shot... ..... 8c

Babbitt Metal.

Babbit Metal, No. 3. 14 X ... 42
Babbit Metal, No-2, 16 XX.. 46
Babbit Metal, No. 1, 18 XXX. 50
Babbit Metal, C..... 20
Babbit Metal, B..... 24
Babbit Metal, A..... 32
Dis 40 per cent.

COPPER.

Lake Ingot.....15¼@16c
Baltimore .....14¾@15c
Arizona ..... 15@15 c

IRON AND STEEL.

Flat Bar.

1½ to 4 by ⅜ to 1 inch..... 1 75
4½ to 6 by ⅜ to 1 inch..... 2 00
1¾ to 6 by 1¼ to 1½ inch . 2 30
1¼ & 1¾ by ⅜ to ½ 2 00
1 & 1¼ by ⅜ to ½.....2 10
⅝ & ¾ and ⅞ by ⅜ to ½....2 20

Round

1 to 1⅜ inch 1 80
2 to 2¾ 2 10
2¾ to 3¼ 2 40
3¾ to 4 ..... 2 90
4¼ to 4½ 3 40
4¾ to 5 ..... 3 60

Square.

1 to 1⅜ inch 1 80
2 to 2¾ 2 10
2¾ to 3¼ 2 40
3¾ to 4 ..... 2 90
4¼ to ⅝ 3 00

Heavy Band.

1½ to 6 by ¼ and 5-16 inch 2 10
1 to 1¾ by ¼ and 5-16 do 2 20
⅝ to ¾ by ¼ and 5-16 do 2 40
⅞ to ⅞ by ¼ and 5-16 do 2 80

Half Oval and Half Round.

Wagon box iron ¼ and ⅜ 3 50
1-10c per lb extra will be charged for cutting to specified lengths

Light Band.

1¼ to 6 by ¼ to 3-16..... 2 70

Hoops.

1¼ to 2 , Nos 16 to 18..... 3 10
1¼ to 4 do 18 to 15..... 3 00
1-10 extra for each gauge lighter

Sheet Iron.

No 22 to 24..... 3 50
No 25 to 26..... 3 70
No 27..... 3 90
No 28 ..... 4 30

English Steel.

Best cast.....℔ lb 16c
Extra cast..... 16½c
Round machinery.. 10c
Swaged, cast 18c
Best double shear ... 15½c
Blister, 1st quality.. 13c
Refined tool steel.... 16½c
Spring calking ..... 7¼@7½c
German steel, best .. 11c
2d quality 10c
3d quality 9c
Sheet cast steel, 1st quality 15½c
2d quality 14½c
3d quality 12½c

American Steel.

Best brands of refined cast steel, ⅜ to 2 inches..12c
Crucible cast.....7c
Open-hearth ditto ... 4½c
Hammer cast steel ... 9c
Spring cast steel..... ¾c
Bessemer and open-hearth spring..... ½c
Ditto plow..... ½c
Steel boiler plate .. 6½@7c
Bessemer machinery .5 @6c
Spring and calking ...7½@7c
Tire 4
Sleigh shoe..... 4

Bessemer Steel Tire.

⅝ to 1 by 3-32 ..... 3¾ ℔ lb
⅝ to 1 by ½ to 5-32 ... 3¾ ℔ lb
⅝ to 1 by 3-16 to ⅝ ... 3¾ ℔ lb

Miscellaneous Cast Steel.

Auger and auger bit..... 10
Axle steel for wagons..... 7
Frog points and plates..... 8
Frog size bars 8
Pick, hammered..... 10¼
Mattock, beveled..... 9
Table cutlery..... 7¾
Trap spring steel..... 10
Pike and cant hook 8¼
Coal and granite..... 9

SCRAP IRON AND OLD METAL.

DEALER'S BUYING PRICES

	Per Ton
No. 1 R R wro't scrap....	$20
No. 1 wrought scrap.....	17
No. 1 Machine cast scrap.	14
Stove plate (free from burnt iron).....	11 00
Grate bars	8 50
Pipes and flues (clean)....	15
Tank iron	14
Hoop and band iron.....	10
Light sheet iron.....	9
Axle turnings.....15 00@16 00	
Wro't turning (f from cast)	13
Wro't iron, oily drillings	9@10
Cast borings.....	9 00
Malleable iron.....	9
Uncut wro't iron boilers ..	15
Old copper per lb.....	11
No. 1 H. Brass per ℔.....	11
Heavy yellow Brass do..	9@11
Light Brass per ℔.....	7@9
Scrap Zinc per ℔.....	2@3
Tea Lead per ℔	3
Heavy Lead per ℔	4

PIPE, WROUGHT.

Standard Wrought Iron Lap Welded Steam and Gas Pipe

	Inside Diameter. Inches.	Weight Per Foot.	Price Per Foot Black.	Price Per Foot Galv'd
Butt-Welded.	⅛	.24	03	
	¼	.42	03	$0 05
	⅜	.56	03½	0 05½
	½	.84	04¾	0 06
	¾	1.12	06	0 07½
	1	1.67	08	0 10½
	1¼	2.24	11	0 14
Lap-Welded.	1½	2.68	21	0 24
	2	3.61	26	0 30
	2½	5.74	38	0 47
	3	7.54	50	0 62
	3½	9.00	67	0 83
	4	10.66	83	1 00
	4½	12.34	1.10	1 25
	5	14.50	1.10	1 10
	6	18.76	1.50	2 00
	7	23.27	2.00	
	8	28.18	2.75	
	9	33.70	3.70	
	10	40.04	4.75	
	11	45.02	5.75	
	12	49.00	6 50	
	13	54.00	7.75	
	14	58.00	9.00	
	15	.....	10.00	

Discount, (car load lots) butt-welded ⅛ inch to 1½ inches plain .....80 per cent.
Ditto galvanized 20 per cent.
Discounts (car load lots) lap-welded 1½ inches to 15 in. plain ..... 50 per cent.
Ditto galvanized 35 per cent.
Discounts on pipe cut to specified lengths depends on size and waste.

Young & Locke,
DEALERS in New and Second-hand
Machinery, Engines, Boilers
and Pumps. Gas and Steam Pipes of every description.
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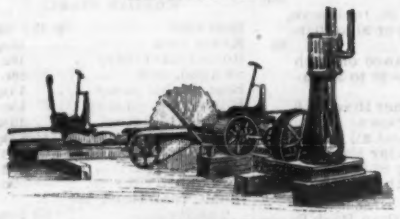
ALLIANCE, OHIO.
Manufacturers of



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Portable Saw Mills,
Suitable for Threshing Engines.
ALSO,
Direct Acting Engines
Coupled to Mill without Belt.
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CHEAPEST STEAM PUMP IN THE WORLD
IN EIGHT SIZES
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Boiler Feeder
STRICTLY FIRST CLASS IN EVERY RESPECT.
SEND FOR NEW & REDUCED PRICE LIST FREE ON APPLICATION
MANUFACTURED BY THE MILLER COMPANY CANTON, OHIO.
Satisfaction Guaranteed or No Pay!

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Stove Work a Specialty.
Cold, Silver and Nickel Plating. Work Guaranteed. We employ Improved Methods of our own in treating this work. Write for prices.
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THE STANDISH
FOOT POWER HAMMER
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Patented July 10, 1883.
It is especially adapted to making
CARRIAGE
And other light Forgings.
Weight 500 pounds.
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PLAIN SIDE VALVE AND AUTOMATIC CUT-OFF
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Send for Price List of Engines and Boilers.
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Manufacturers of
Roofing Felt,
Slaters' Felt,
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The Largest Manufacturersof Iron Roofing in the World.
Manufacturers of all kinds of
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CRIMPED AND CORRUGATED SIDING,
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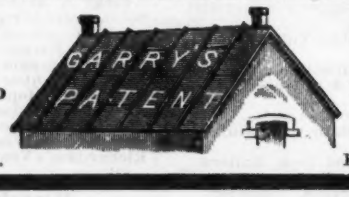

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HORIZONTAL BORING MACHINE.
73 Offices: 220 Franklin street, Boston, Mass., 228 Lake street, Chicago, Ill.

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CASTINGS
For Machinery and Rolling Mills.
Car Wheels
all sizes and kinds, with and without Axles.
Chilled Faced R. R. Frogs.
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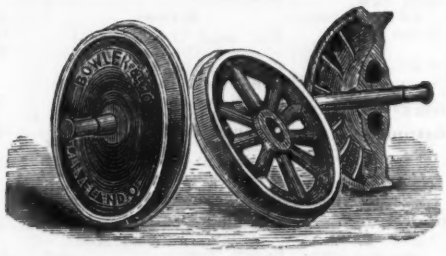

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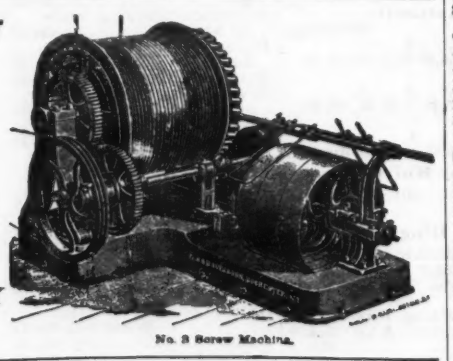
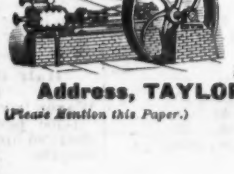
Send for our Catalogue.


No. 3 Screw Machine.



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Also, SHAFTING, HANGERS and IRON PULLEYS.
Responsible agents wanted where I have none. Address,
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The Cleveland, Mt. Vernon and Delaware RAILROAD.

"Cleveland, Akron & Columbus."

In effect November 18, 1883, based on Central Standard Time.

GOING NORTH.

STATIONS.	No. 1.	No. 3.	No. 5.	No. 7.
Leave				
Columbus	6 45	11 40	.....	16 50
Westerville	7 10	12 05	.....	17 18
Centerburg	7 52	12 47	.....	18 04
Mt. Vernon	8 37 B	13 31 D	.....	18 50 S
Gambier	8 49	13 41	.....	19 01
Danville	9 09	14 01	.....	19 23
Gann	9 21	14 11	.....	19 35
Millersburg	10 14	14 59	5 30am	.....
Fredricksb'g	10 37	15 19	5 51	.....
Orrville	11 12	15 50	6 50 B	.....
Warwick	11 36	16 11	7 16	.....
Clinton	11 42	16 16	7 23	.....
Akron	12 15	16 46	7 57	.....
C'yahoga F's	12 30	16 58	8 11	.....
Hudson	12 50	17 15	8 30	.....
Ar. Clevel'd	14 12	18 25	9 50	.....

GOING SOUTH

	No. 2.	No. 4.	No. 6.	No. 10.
Leave.				
Cleveland	8 00	14 00	15 15	16 50
Hudson	9 17	5 10	16 30	18 15
Cuyahoga F's.	9 35	15 28	16 54	18 50
Akron	9 51	15 44	17 11	19 45
Clinton	10 22	16 16	17 43	.....
Warwick	10 26	16 21	17 48	.....
Orrville	10 51	16 47	18 14	.....
Fredricksburg	11 22	17 18	18 48	.....
Millersburg	11 45	17 40	19 10	No. 8.
Gann	12 32	18 30	.....	5 50
Danville	12 44	18 41	.....	6 01
Gambier	13 04	19 01	.....	6 21
Mt. Vernon	13 29 D	19 26 S	.....	6 50 B
Centerburg	14 01	20 00	.....	7 25
Westerville	14 45	20 45	.....	8 13
Columbus arr.	15 10	21 10	.....	8 40

The system used in the above table consists in avoiding the confusing division of the day into two equal portions of 12 hours each, and employing instead a continuous count from 1 to 24. The days begins at Midnight, as under the common system, but there is no possibility of confusion between the forenoon and afternoon hours.

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Gen. Pass. Ag't, Columbus, O.
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Central or Ninetieth Meridian time, 33 minutes slower than Cleveland city time.

Until further notice trains will leave the new Central Depot, South Water Street and Viaduct, as follows:

6 50A.M. LIGHTNINGEXPRESS(daily) sleepingand hotel coaches from Leavittsburg. 8:35 a.m. To New York, Albany and Boston without change. Arrives at Meadville 10:40 a.m., (dinner); Franklin, 12:08 p.m. Oil City, 12:30 p.m.; Corry, 12:55 p.m.; Jamestown, (Lake Chatauqua) 1:35 p.m.; Buffalo, 5:50 p.m.; Rochester, 8:20 p.m.; Hornellsville, 6:00 p.m.; (supper); Corning, 7:25 p.m.; Elmira, 8:05 p.m.; Binghampton, 10:05 p.m.; Albany, 5:00 a.m.; Boston, 1:45 p.m.; arriving at New York, 6:15 a.m.

2:20P.M. LIMITED EXPRESS, Pullsleeper Cleveland to New York, (daily). Arrives at Meadville, 6:30 p.m.; Jamestown, 8;47 p.m.; Salamanca, 9:45 p.m.; New York, 10:10 a.m.

11:00 P.M. NIGHT EXPRESS, (daily except Sunday), Sleeping Coach from Leavittsburg to New York without change. Arrives at Youngstown, 1:50 a.m.; Pittsburgh, 5:50 a.m.; Washington 0:00 a.m. Baltimore 00:00 p.m.; Meadville, 3:25 a.m. Corry, 4:59 a.m.; Jamestown, 5:57 a.m.; Buffalo, 9:20 a.m.; Rochester, 12:58 p.m.; Hornellsville 11:00 a.m.; Corning, 12:07 p.m.; Elmira 12:40 p.m.; Binghampton, 2:19 p.m.; New York 9:10 p.m.

2:20 P.M. PITTSBURGH EXPRESS, daily, through without change. Parlor Car, Cleveland to Pittsburgh, arrives at Youngstown, 5:00 p.m.; Pittsburgh, 8:02 p.m.; Washington, 7:09 a.m.; Baltimore, 8:19 a.m

4:10 P.M. MAHONING ACCOMMODATION, stopping at all way stations. Arrives at Youngstown, 6:55 p.m; Sharon, 8:01 p.m; Sharpsville 8:10 p.m; connects at Leavittsburg with train No. 20 for Meadville and intermediate points, arrives at Meadville, 11:05 p.m. Pittsburgh, 00:00 p.m.

6:50 A.M. PITTSBURGH EXPRESS, —(daily) through without change. Arrives at Youngstown, 9:30 a.m.; Sharon, 10:30 a.m.; Sharpsville, 10:40 a.m.; Pittsburgh, 12:45 p.m. Returning, leave Pittsburgh, 4:15 a.m., 7:45 a.m., and 12:55 p.m. and 3:45 p.m.

10:35 A.M. YOUNGSTOWN & PITTSBURGH Accommodation, stopping at all Way Stations, arriving at Youngstown 1:30 p.m.; Pittsburgh, 5:45 p.m. Trains arrive at Cleveland, 6:15 a.m., 6:30 p.m., 10:30 a.m. 1:05 p.m., and 9:45 p.m.

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Will Low Water Cause a Boiler Explosion?

Concluded from Page 50.

may, or may not, explode a boiler; also that boiler explosions may be caused by low water and by a number of other causes. BOILER.

NEW YORK, January 5, 1884.

A New Pulley.

A pulley of decided novelty, the manufacture of which has just commenced at three points in the United States, is illustrated herewith. It is the invention of Messrs. Harmon H. Fulton and Christoph Olsen, both of the Indianapolis Machine and Bolt Co. By reference to Fig. 1 it will be seen that the pulley consists of three parts—the rim, the center and the hub. The rim and center are of steel, while the hub is malleable iron. One great feature of the Fulton Pulley lies in the corrugations of the steel center, or disc. Every machinist will at once recognize the immense additional strength imparted to the pulley by these corrugations. They may be laid on concentrically, as in the cut, or radially, to meet the wishes of users. The corrugating of these discs is done by a powerful press made especially for the purpose, after long and expensive experimenting. The sheet of hot steel is placed in the press and the die brought down with great force, not only corrugating the disc, but punching out every alternate "ear," by which the rim is afterward to be made fast. The withdrawal of the die pulls up the other alternate ears, thus by one operation leaving the center fully corrugated, and the ears bent alternately to one side and the other, ready for finishing. The rim, as before stated, is of steel. This rim is drawn around the centre of the disc while cold by powerful machinery, and there riveted to the ear. The place of meeting of the two ends of the rims is a double joint, and as strong as any other joint in the periphery of the pulley. The hub is cast in two halves, one for each side of the wheel; the face of each half being cast with a corrugation to fit snugly to that of the steel disc. The two halves of the hub are placed in position and bolted firmly together through the disc.

A sectional view of the pulley is shown in Fig. 2, and fully illustrates the method of joining the various parts. This cut also shows the form of the corrugations on the steel disc, with the alternate ears on either side riveted to the rim. The rivet holes are punched and the riveting completed while the pulley is in the chuck, so that when it is released the pulley is made. Fig. 2 also shows the hub with its corrugations closely hugging the disc, held there by the bolts.

A split pulley is also made under the Fulton patents, which is so cheaply done as to bring the price down nearly to that of the ordinary pulley; in other words, almost 50 per cent. cheaper than the ordinary iron split pulley. Following are the advantages claimed for this invention: First, it is lighter than any other metal pulley now in use, having only about half the weight of the lightest of these. Second, it is fully as strong in doing its work, and is absolutely free from any danger of breakage. Third, it is perfectly balanced from the moment the rim is drawn into position. Fourth, the lightness of the pulley admits of a far lighter hanger, thus decreasing cost in this way. Fifth, the friction is greatly reduced, enabling a lighter shaft to do the same amount of work. Sixth, a great saving of labor is effected by using the Fulton Pulley, when placing it in position, because of its extreme lightness.

One of these pulleys has been subjected to asevere test, with such satisfactory results, that we give it here. The pulley was 30x12 and was put on the main shaft in the Indianapolis Machine and Bolt Works, in place of a 28x8 pulley. The belt was not even let out to allow for this difference in size, but was forcibly stretched on just as it was. So great was the strain that one side of the lacing burst, and it took the combined strength of five men to put the belt on. Yet the pulley sustained the strain with no sign of giving. It was at once put to work, and drove two large Sturtevant fans, two bolt cutters and a couple of tappers, with perfect ease.

The Fulton Pulley will be manufactured by three well known firms, The Indianapolis Machine & Bolt Works, Indianapolis Ind., The John T. Noye Manufacturing Co., Buffalo, N. Y., and the Falls Rivet Co., of Cuyahoga Falls, O. The standing of these establishments is a guarantee of the excellence of the work on the new pulley.

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MALLEABLE IRON WORKS

of Akron. Two large Annealing Ovens with equipments for same; Japanning and Tinning Rooms; good Boiler and Engine of 25-horse power; machine and store house two stories, 25x50 feet, containing pulleys, hangings, benches, polishing barrels, etc.; Moulding Foundry 50x70 feet, including cupola, ladles, crane, core-oven and air-furnace with a fine high stack.

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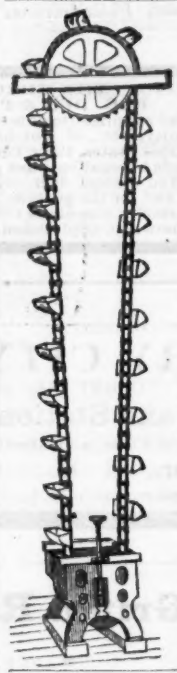

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For Elevators, Conveyors, Carriers, etc., and for Driving Purposes.

Recommended as a superior chain belting, having greater wearing surface, and in connection with the Friction Roller, longer lived, than any similar belting.

Manufactured and sold by the

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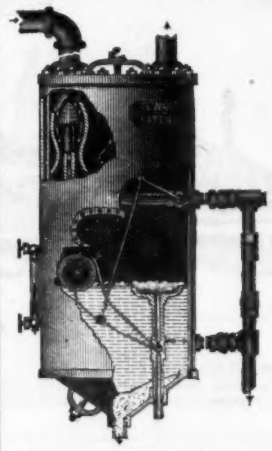
Manufacturers and Patentees of

STEWART'S

Patent Heater Purifier And Water Catcher



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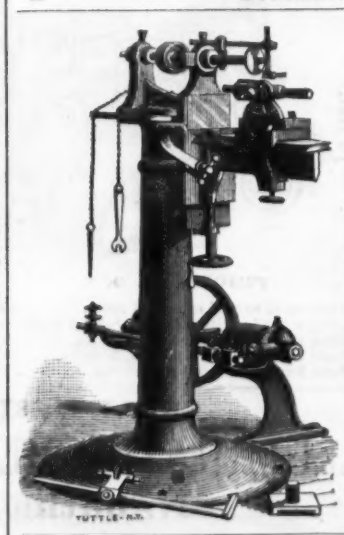

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N.Y., Bo'f'n & At. Ex.	*6 37 a m	*7 02 a m
Elyria Accommodation	†8 07 a m	.....
Pt. Clinton Accomd'at'n	†10 37 a m	.....
Buffalo Accommodation	†10 37 a m	†10 52 a m
N. Y and B'f'n Fast Ex.	*1 57 p m	*2 27 p m
Cincinnati and St Louis Ex	.....	3 27 p m
Conneaut Accom'dation	.....	†4 22 p m
Night Exp via Norwalk	† 9 42 p m	†10 07 p m
Night Exp via San'sky	9 44 p m	.....

TRAINS GOING WEST.	Arrive. From East.	Depart. For West.
Fast Limited Express	*11 55 a m	*12 05 a m
Mich. Ex. via Sandusky	*2 22 a m	*2 37 a m
Chi. Ex. via Sandusky	†6 07 a m	6 32 a m
Mich. Ac. via Norwalk	.....	†6 12 a m
Conneaut Accom'dat'n	†8 12 a m	.....
Toledo Ex. via Norwalk	†12 52 p m	†3 02 p m
St. Louis Ex. via San'ky	*1 02 p m	*1 25 p m
Chi. Pac. Ex. via Nor'lk.	*6 02 p m	*6 32 p m
Pt. Clinton Accom'dat'n	.....	†4 32 p m

Sunday trains for Nottingham—Depart 8:32 a. m. and 1:47 p. m., return at 9:37 a. m. and 4:17 p. m.

Reference marks—*Daily. †Daily except Sunday. ‡Daily except Monday.

Cleveland, Columbus Cincinnati & Indianapolis.

Central standard time, 33 minutes slower than Cleveland time.

ARRIVALS.

No. 2 Col. & Cin. & Ind'polis Ex.	*6 45 A.M
No. 8 C. L. & W. and Galion Exp	9 10
No. 12 St. Louis & New York Exp.	*2 50 P.M
No 6 Indianapolis & Columbus Exp	9 55
No 4 Columbus & Cincinnati Exp.	*8 20
No. 10 Wheeling Express	6 45
No. 14 Cincin. New York fast line,	1 10 A.M

DEPARTURES.

No. 1 Cincinnati & Columbus Exp.	*7 30 A.M
No. 11 Cleve, Indianap. & Wheel'g Ex	6 40
No. 3 Special St. Louis & Cin. Ex.	**1 40 P.M
No. 5 Night Express,	*6 40
No. 7 C. L. & W. and Galion Exp	4 30
No. 17 Spec. Col. Cin'ti. Exp.	1 30

**This train runs daily to Indianapolis and St. Louis, and daily, except Sunday, to Cincinnati.

Cleveland & Pittsburgh.

The time given is the central standard time, thirty-three minutes slower than Cleveland time.

	DEPART	ARRIVE.
Pittsburg & Wheeling	8 00 A.M	2 12 P.M
Express	2 00 P.M	6 25
Alliance Accommodation	8 15	9 50 A.M
Ravenna Accommoda	4 50	8 12
Night Express	†11 10 P.M	5 55 A.M
Newburg Accom'dation	10 30 A.M	11 40
Newburg Accom'dation	12 00 M.	1 20 P.M

† Night Express runs daily, except Saturday, by way of Wellaville, and on Saturday by way of Alliance. All other trains daily except Sunday.

"The Nickel Plate."

Ninetieth meridian time.

Going East.	ARRIVE.	DEPART
Buffalo Accom.	10 22 a.m.	10 27 a.m.
Conneaut Accom.	....	3 52 p.m.
Chicago Accom.	9 02 p.m.	
Local Freight	11 35 p.m.	12 17 p.m.
Going West.	**ARRIVE.**	**DEPART.**
Chicago Accom.	....	6 47 a.m.
Conneaut Accom.	8 57 a.m.	
Bellevue Accom.	4 52 p.m.	4 57 p.m.
Local Freight	12 44 p.m.	1 22 p.m.

Rocky River Accommodation departs 5 52 a.m.; 1 47 p.m.

Euclid Accommodation departs 7 02 a.m.; 11 42 p.m., 5 17 p.m.

All trains daily except Sunday.

New York, Pennsylvania & Ohio.

New standard central, or Ninetieth meridian time, 33 minutes slower than Cleveland city time.

DEPARTURES.	a.m.	p.m.
N. Y. & Pitts. Express	* 6 50	11 00
Youngstown & Pitts. Ac.	10 35	....
Fast N. Y. & Pitts. Express	....	* 2 20
Mahoning Accommodation	....	4 10
N. Y. and Pitts. Express	....	11 00
ARRIVALS.	**a.m.**	**p.m.**
New York Express	* 6 15	....
Mahoning Valley Ac.	10 20	....
Fast N. Y. & Pitts. Ex	....	* 1 05
N. Y. & Pittsburgh Ex.	....	* 6 30
Youngstown & Pitts. Ac.	....	9 45

* Sunday trains.

Valley Railway.

Central Standard time.

	ARRIVE.	DEPART
Wheeling Junction	9 47 A.M	8 02 A.M
Canton	1 07 P.M	5 47 P.M
Wheeling Junction	5 47 P.M	2 58 P.M

Special trains leave on Sunday at 3.50 P.M., arriving at Cleveland at 6.42 P.M.

Depot foot of South Water Street.

Connotton Valley Railway.

Standard Time.

Trains arrive:	A. M.	P. M.
Canton, Sherrodsville & Coshc'ton	9 47	7 07
Canton & Coshocton	....	1 02
Kent accommodation	7 37	....

Newburgh 7:03 a. m., 8:32 a. m. 1:52 p. m., 4:17 p.m., 6:42 p. m., 10:07 p.m.

Trains leave Cleveland,	A. M.	P. M.
Canton, Coshocton & Sherrodsville	7 02	....
Canton & Sherrodsville	....	2 07
Canton & Coshocton	7 02	3 42
Kent accommodation	....	5 12

Cleveland and Newburgh, 6:12 a. m., 7:47 a.m., 10:32 a.m., 2:52 p.m., 5:52 p.m., 5:12 p.m.

Newburgh and Bedford ..... 10:32 p.m.

Trains Sunday only depart for Bedford 8:07 p.m., 10:07 a.m., 9:02 p.m.; Newburgh, 1:42 p.m.; Kent Accommodation 5:12 p.m.

Trains arrive, Kent Accommodation 7:37 p.m. Bedford 8:46 p.m., 1:27 p.m., 6:55 p.m.; Newburgh 2:32.

Depot corner Huron and Ontario streets.

Cleveland, Akron & Columbus Railroad.

Cleveland, Akron & Columbus Railroad, running over Cleveland & Pittsburgh Railroad to Hudson, for Akron, Columbus, etc.

	ARRIVE.	DEPART.
Mail	2 30 P.M	8 25 A.M
Express	7 30	2 00 P.M
Accommodation	10 10 A.M	3 45 P.M

Cleveland, Lorain & Wheeling.

ARRIVALS.	
Wheeling & Cleveland Express	7 15 P.M
Uhrichsville Express	9 30 A.M
DEPARTURES.	
Wheeling & Cleveland Express	7 10 A.M
Uhrichsville Express	5 00 P.M

THE NICKEL PLATE.

New York, Chicago & St. Louis Railroad.

The passenger equipment of this new trunk line is all new and is supplied with the latest appliances necessary to safe, speedy and comfortable travel.

At Chicago, Passenger Trains arrive at and leave Union Depot, Van Buren street.

Following is the time in effect Nov. 18, 1883, and until further notice:

GOING EAST.

	Local Pass'n'gr	Local Pass'ngr.	Conenaut Accom.
Lv. Chicago	7 47 am	.....	.....
Ar. Valparaiso	9 37	.....	.....
" Ft. Wayne	1 00 pm	.....	.....
" New Haven	1 35	.....	.....
" West Leipsic	3 45	.....	.....
" Arcadia	4 44	.....	.....
" Fostoria	4 57	.....	.....
" Gr. Springs	5 44	.....	.....
" Bellevue	6 12	.....	.....
Lv Bellevue	6 22	7 52 am	.....
Ar Lorain	7 50	9 16	.....
Ar Cleveland	9 02 pm	10 22	.....
Lv Cleveland	.....	10 27	3 52 pm
Ar Painesville	.....	11 33	5 05
" Ashtabula	.....	12 25 pm	6 03
" Conneaut	.....	1 07	6 32
" Erie	.....	2 09	.....
" Dunkirk	.....	3 47	.....
" Buffalo	.....	5 22	.....

GOING WEST.

	Local Pasn'gr.	Local Pass'ngr.	Con'enaut Accom.
Lv Buffalo	.....	9 47 am	.....
Ar Dunkirk	.....	11 24	.....
" Erie	.....	1 33 pm	Leave.
" Conneaut	.....	2 17	6 17 am
" Ashtabula	.....	2 50	6 46
" Painesville	.....	3 44	7 43
" Cleveland	.....	4 52	8 57
Lv Cleveland	6 47 am	4 57	.....
Ar Lorain	7 53	6 12	.....
Ar Bellevue	9 17	7 37	.....
Lv Bellevue	9 23	.....	.....
Ar Gr. Springs	9 44	.....	.....
" Fostoria	10 22	.....	.....
" Arcadia	10 34	.....	.....
" West Leipsic	11 30	.....	.....
" New Haven	1 35 pm	.....	.....
" Ft Wayne	1 52	.....	.....
" Valparaiso	5 55	.....	.....
" Chicago	7 52	.....	.....

Trains run by Ninetieth meridian time, which is nine minutes slower than Chicago time, twenty-eight minutes slower than Columbus time, thirty-three minutes slower than Cleveland time, forty-four minutes slower than Buffalo city time, and sixty minutes slower than Seventy-fifth meridian time.

For information, call on nearest Agent of the Company or address

B. F. HORNER,
Gen'l Passenger Agent.
LEWIS WILLIAMS,
General Manager, Cleveland O.

Bee Line.

Cleveland, Columbus, Cincinnati & Indianapolis Railway.

The Great Central Trunk Route to the Ohio and Mississippi Rivers.

Three Trains Week Days,

TWO TRAINS SUNDAY.

Leave Cleveland with Through Palace Coaches and Elegant Sleeping Cars for

Columbus, Cincinnati, Indianapolis, Terre Haute and St. Louis

Without Change.

This is the only line making Direct Connection with all the principal Trunk Lines of the East for all Southern, Southwestern and Western points, either by way of Cincinnati, Indianapolis or St. Louis for all railway towns in Missouri, Arkansas, Texas, Kansas, Nebraska, Colorado, New Mexico, Old Mexico and the Pacific Coast.

Equipment New and Comprising all Modern Improvements.

The Best Roadbed and Safest Road in the West.

Tickets by this popular route for sale at all regular ticket offices.

E. B. Thomas, General Manager. **O. B. Skinner,** Traffic Manager.

A. J. Smith,
Gen'l Pass. Agent, CLEVELAND, O

JOHN H. O'MARA,

NEW LISBON, OHIO,

Manufacturer of the celebrated

EXCELSIOR DIAMOND GRIT

GRINDSTONES

The best in the market

FOR WET AND DRY GRINDING,

AND FAST CUTTING.

Manufactured in sizes from 3 feet 6 inches to 8 feet in diameter; in thickness from 6 inches to 25 inches. Orders solicited.

82 JOHN H. O'MARA.

DEAD-STROKE

Power Hammers.

Construction Improved. Seven Sizes. 5 to 250 Pounds. Over 600 in Use. Prices reduced March 1st.

The 15 and 25 pound sizes are specially adapted for Filemakers' use, the other sizes for general forging. Send for circular and references.

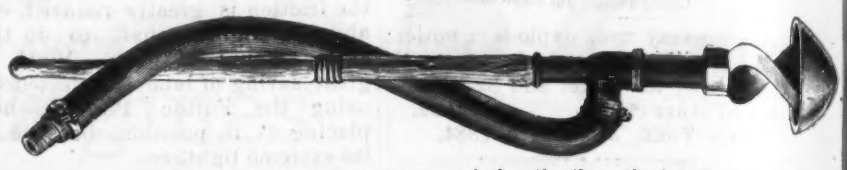
DIENELT & EISENHARDT,

MAKERS,

1306 Howard Street, Philadelphia.

The Cyclone Boiler Flue Cleaner,

Gerlach's pat. June 5, 1883.



The auger shaped steam passage gives the steam a spiral motion the entire length of tubes, thereby thoroughly cleaning a set of tubes in 5 minutes.

Improving the draft, saving fuel and labor.

No steam user should be without one.

Circulars free, liberal discount to dealers.

CRESCENT MANUFACTURING CO.
5 Michigan street, Cleveland, O.
93

Established 1841. THE MERCANTILE AGENCY. [94 Branch Offices.
R. G. DUN & COMPANY, Proprietors.

This establishment supplies (to subscribers only) all necessary information as to the standing, responsibility, etc., of merchants, traders, manufacturers, public companies, etc., through the United States, their Territories and British North America. Also, makes collections and attends to legal business generally. It is the oldest and by far the most complete and extensive system ever organized for the accommodation of banking and mercantile interests and for the general promotion and protection of trade. Reference books published quarterly. Cleveland Office—Rooms 4 and 5, No. 121 Superior-st. Terms of subscription made known on application. **R. P. CATTRALL, Manager.** 2

CORRY CITY IRON WORKS,

CORRY, PA., manufacturers of all sizes of

Portable and Stationary Engines and Boilers,

and all kinds of **Plate and Sheet Iron Work.** Also manufacturers of the

Celebrated Gladiator Agricultural Engine,

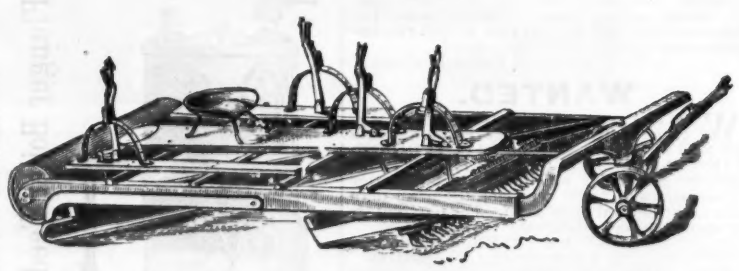
the lightest and safest engine built, having a perfect Spark Arrester. Send for Circular.

The Griffin Road Machine Co.

MANUFACTURERS OF

Road and Track Machines,

Elyria, O.

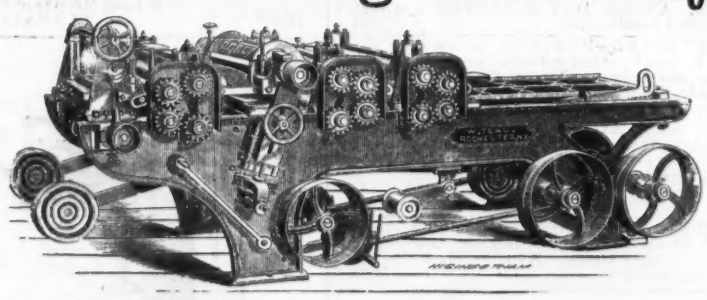


CITY SURVEYOR'S OFFICE,
LANSING, MICH., May 3, 1883.

The Griffin Road Machine Co.

Gents,—We have had your machine running for a month, and are highly pleased with it. It has already more than paid for itself by the saving of labor. H. D. BARTHOLOMEW,
City Surveyor.
22

Wood-Working Machinery.



Length of Frame, 10 feet.

Weight, 3,600 to 4,700 Pounds.

PRICES—NO. 2.

To plane on side and match, 4 rolls,	$500
To surface 1 side without matching 4 rolls,	400
To plane one side and match, 6 rolls,	565
To plane two sides and match, 6 rolls,	650
To plane 2 sides without matching, 6 rolls,	500

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ROCHESTER, N. Y.

GREAT WESTERN OIL WORKS.

ILLUMINATI'G OILS, LUBRICATI'G OILS.

Naphtha & Gasoline.

Orders solicited in Bulk, Barrels or Cases.

Scofield, Shurmer & Teagle, 1

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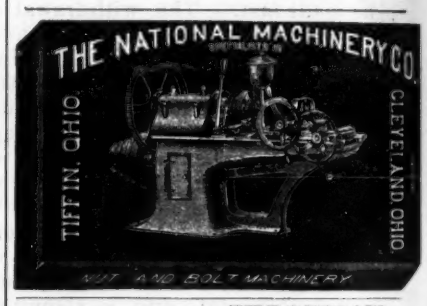
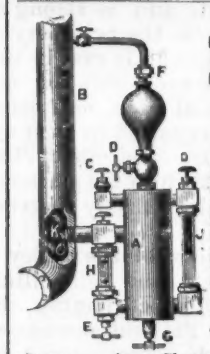
Can learn the exact cost of any proposed line of Advertising in American Papers by addressing Geo. P. Rowell & Co's Newspaper Adv'g Bureau, 10 Spruce St., N.Y.





THE DETROIT

Lubricator Co.'s

SIGHT FEED LUBRICATOR CUPS.

For oiling valves and cylinders of steam engines, by the only perfect method, through the steam pipe. The oil passes in sight, drop by drop, into the column of steam where it vaporizes, thus becoming a STEAM LUBRICANT, oiling perfectly every part reached by the steam. Any Clean Oil, black or white, light or heavy, may be used. Saves from 50 to 90 per cent. in oil and wear of machinery, thus paying for itself several times a year. A cup will be sent to responsible parties on twenty days' trial if desired. In ordering give diameter of cylinder.

NOTICE.

The first lubricators ever made, showing the oil passing drop by drop through a transparant water chamber, were devised by us, and the same are fully embraced by many Letters Patent owned and controlled by us, which have been sustained in several hotly contested legal contests. Our customers, therefore, need have NO FEARS in their purchase and use. We are the sole owners of the "Sight Feed" feature as claimed by us, and we shall hold purchasers and users responsible who are encroaching upon our rights by the unlawful use of our device.

DETROIT LUBRICATOR CO.
Office 98 Griswold street, Detroit, Mich.

Note—In our recent suit against the American Lubricator Co., of Detroit, before Justice Stanley Matthews, of the U. S. Supreme Court, involving their "Sight Feed" feature, a decree was rendered in our favor August 20, 1881. (Mention this paper.)

☞ WM. BINGHAM & CO., Sole Agents for this territory

MACHINERY FOR

Straightening & Cutting Wire

Of all Sizes to any Length.
Send for Catalogue.

JNO. ADT & SON,
New Haven, Conn., U. S. A.

THE HOTCHKISS MECHANICAL

BOILER CLEANER

AN AUTOMATIC DEVICE

FOR REMOVING MUD

AND

Preventing Scale

AND FOAMING.

Patented 1875.

Simplest, Best and Cheapest. "How to Keep Boilers Clean," a 72-page book, sent free to any address, on sending your name on a Postal Card.

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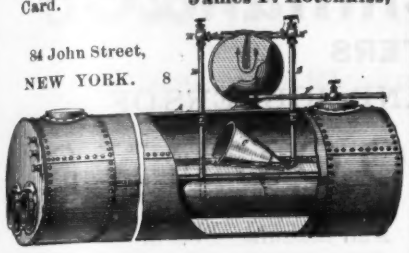
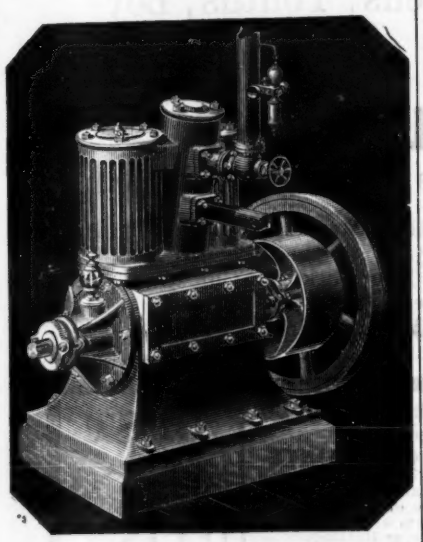
84 John Street,

NEW YORK. 8





The Westinghouse Automatic Engine

The best evidence of its peculiar merit is the fact that our

Shipments average Two Engines per day.

Over 600 Engines and 16,000 H. P. now in operation.

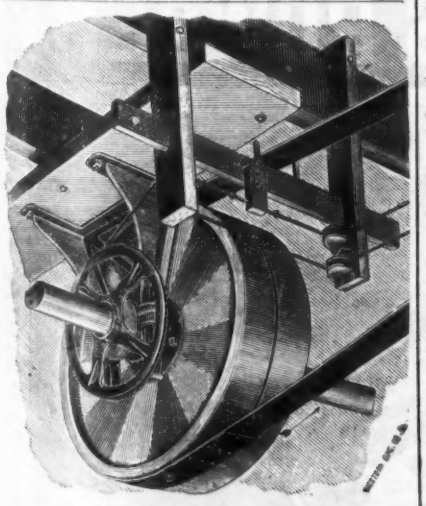
OUR PRICES ARE MODERATE.

Send for Illustrated Circular and Reference List.

The Westinghouse Machine Comp'y

PITTSBURGH, PA.

Branch Offices: 94 Liberty St., NEW YORK, 14 So. Canal St., CHICAGO, 401 Elm St., DALLAS, TEXAS



Adjustable Dead Pulleys.

Taper Sleeve Pulley Works.

MANUFACTURERS of Taper-Sleeve Wood Belt Pulleys, Taper Sleeve and Compression Couplings, Adjustable Dead Pulleys, Wood Pulleys Split or made in Halves, Friction Clutch Pulleys, and Friction Clutch Couplings. You can start a load with this clutch, at any speed, with ease and safety.

ERIE, PA.

Cleveland Business Directory.

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Bolt and Nut Works.

HOTCHKISS & UPSON MANUFACTURING CO. Manuf'rs. Machine, Plow & Elevator Bolts, Coach Screws. I5

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SMITH & TEACHOUT— (Established 1857.) Boiler, Tanks, Stills etc. 644 Broadway.

CHATTERTON, J. Boiler Maker. Repairing a Specialty. 30 West River St. 4

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BUCKEYE BRIDGE AND BOILER WORKS, mfrs of Arch & Truss Bridges, Boiler Tanks and Oil Stills. Bet. Wasson St. and Case Ave.

Boiler Feeder

EBERMANN, W. S. & SONS, manfrs. of the celebrated Ebermann Boiler Feeder. Send for Circulars and Price List. 2

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JACKSON IRON CO. Iron Ore and Pig Iron. Fayette Brown, Gen. Agent. 101 St. Clair street. 15

RHODES & CO. Coal, Iron Ore and Pig Iron. 101 St. Clair street. 1

DALLIBA, J. H., Iron Ore. Grand Arcade Building, 101 St Clair st. 51

Carriage Bolts.

THE COLWELL & COLLINS NORWAY BOLT CO., manufacturers of Philadelphia Carriage and Tire Bolts. 41

Carriage Repository.

GREENE'S, J. O., Carriage Repository, 408 Superior street and 52, 54 & 56 Rockwell street, dealer in Fine Carriages. Repair shop in connection. 41

Dyers.

BICHLMYER, A., 122 Seneca st. Gentlemen's and Ladies' Clothes Cleaned and Dyed. 74

File and Saw Works.

PARKIN, W. H. & CO., Hand-cut Files and Rasps, dealers in Disston's saws. No. 11 South Water street. 51

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BOWLER & CO., Car Wheels, Patent Chilled Frogs, and all kinds of castings. 9 Winter.

LAKE SHORE FOUNDRY, Water and Gas Pipe, Light and Heavy Castings. Alabama st. 61

TAYLOR & BOGGIS, successors to H. & H. F. Taylor, Iron Founders, 65 to 73 Central Way. 63

FITZSIMONS WM. & SON, Rolling Mill and Machinery castings. Rolls a Specialty. No. 435 Broadway. 64

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DENNISON BROS., dealers in Hides, Pelts, Furs and Tallow, 48 and 50 River street. 33

Hardwood Lumber.

MARTIN & BARRIS, dealers in all kinds of Hardwood Lumber. 130 Central Way. 51

Hardware and Iron.

BINGHAM, WM. & CO., Hardware, Iron, Nails and Metals, 148 and 150 Water street.

CLEVELAND ROLLING MILL CO., manufacturers of Steel and Iron Wire and Steel Tire. 34

Lumber.

WOODS, PERRY & CO., manufacturers and dealers in Lumber, Lath, etc., 5 Carter st. 4

FISHER, WILSON & CO., wholesale lumber dealers (pine & hard wood), rough and dressed umber, timber, lath, shingles, etc. 47 Central Way. 82

KRAUSE, C. A., & SON, wholesale and retail dealers in lumber. Yards cor. Superior and Wason and 281 Merwin streets. 64

Lime Manufacturers.

RUSSELL LIME CO., manufacturers of White Lime; also dealers in Plaster, Cement, etc. 85 Elm street. 34

Machinery and Boilers.

KRITCH, K. E. Metal Pattern Maker. Small machinery repaired. Lawn Mower sharpening a specialty. 42 South Water Street. 71

Oil Manufacturers.

AMERICAN LUBRICATING OIL CO. manf'rs of lubricating oils, 22 Euclid ave, 84

Stair Builder.

PFEIL, CHAS, Stair Builder; Hard Wood Mantles and Office Railing. Works, 49 & 51 Canal street, Cleveland, Ohio. 41

Cleveland Business Directory.

Steel Stamps and Stencils.

FLEHARTY, J. H. & CO., Rubber Stamps, Seals, Stencils. 197 Superior street. 54

Steam Furnaces.

CUYAHOGA ST AM FURNACE CO. build large engines for Stationary and Marine purposes. Blowing Engines for Blast Furnaces and Steel Works. Steam Pumps for Copper Mines, and Steam Helve Hammers for Forges and Bloomeries. Make all kinds of heavy Castings. Foundry and Machine Shop corner Detroit and Center Streets.

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FABER, J. manuf. Trunk, Traveling Bags and Ladies' Fine Satchels. Sample trunks and Cases a Specialty. 56 Public Square 54

Business Directory.

Akron, O.

AKRON IRON CO., manufacture best Common, Refined and Charcoal Iron.

MCNEIL, J. C., Steam Boilers, Heavy Sheet Iron Work. Repairing promptly executed.

TAPLIN, RICE & CO., manuf'rs. of Stoves and Hollow Ware, dealers in Tinners' Stock, etc. 04

WEBSTER, CAMP & LANE MACHINE CO., Founders and Machinists, 12 Main street. 84

CAHOW BROS. manfrs. of and dealers in Wood and Metal Pumps, Pipe, etc. 225 West Market street. 42

MAY & FIEBEGER, Galvanized Iron Cornices. Send your plans for estimates. 62

Alliance, O.

MCFARLAND, J. W. Engine and Machine Builder, and General Machine Jobbing, 41

Buffalo, N. Y.

WHITE, L. & I., manf'r's of Coopers' Tools. Carpenters' Tools, and Ship Tools. Also manf'r's of Planer Knives and Machine Cutters to order 310-314 Exchange street. 38

THE BUFFALO NUT AND BOLT CO.—[Limited.] Manufrs. of Hot Pressed Nuts, Bolts, Washers, Rivets, &c. 226 Ohio St. 31

Bridgeport, Ct.

ATLANTIC HOTEL, directly opposite the Railroad Depot. D. Foland, proprietor. W. Foland, H. W. Terrell, Clerks; Wm. Richardson, Night Clerk. 2

Canton, O.

NOVELTY IRON WORKS, Mill work, Shafting, engines, Imperial job printing press, etc. 73

BELDEN BURNER CO.—H. S. Belden—B. C. Goodrill. 158 and 160 S. Market-st., Manfrs of gasoline burners and fixtures, and contractors for lighting streets. 2

THE SUN VAPOR LIGHT & STOVE CO., manufacturers of Vapor Gas Lights, Gasoline Stoves and Tinner's Soldering Furnaces. Contractors for lighting the streets of cities and towns. No. 116 E. 5th Street 72

Columbus, O.

REYNOLDS BROS., manufact'rs of hand-cut Files and Rasps. Old files re-cut. Send for Price List. 11

CITY BOILER WORKS, manfrs of Stationary, Portable and Locomotive Steam Boilers. All work warranted. Borger Bros. & Co. 68

ZELOTES WOOD & CO., manfrs of Malleable Iron. Cor. Randolph and West streets. 18

Cuyahoga Falls, O.

THE CUYAHOGA FORGE AND IRON CO. manfrs. of every description Car. Truck & Driving Axles, Forging, Shafting, 71

Cincinnati, O.

THE CINCINNATI STEAM HEATING CO. mfrs, dealers and contractors. Warming and Ventilation of public and private buildings a specialty. Boilers, Radiation, Pipe, Fittings, Brass Goods, &c. Correspondence solicited. 187 West Pearl street. 95

Erie, Pa.

BALL ENGINE CO., manufacturers of Automatic Engines of 15 to 60 horse power.

Lima, O.

LIMA HOUSE, centrally located; telegraph office in the house. J. Goldsmith, Prop.

Meadville, Pa.

CURRY & CO. general jobbers in Castings of all kinds. 42

Niles, O.

REEVES Bros., Manufacturers of Boiler, Tank and Sheet Iron work, etc. 64

Olean, N. Y.

MYRICK BROS. & CO., manufact'rs Engines and Boilers, oil drilling tools, rig irons, etc. 72

Business Directory.

Oil City, Pa.

REID, JOS. Machinist, steam engine and pump repairing. Brass and iron castings, light and heavy, made on short notice. 2

New Haven, Conn.

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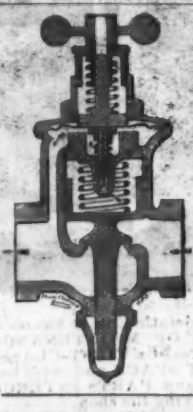

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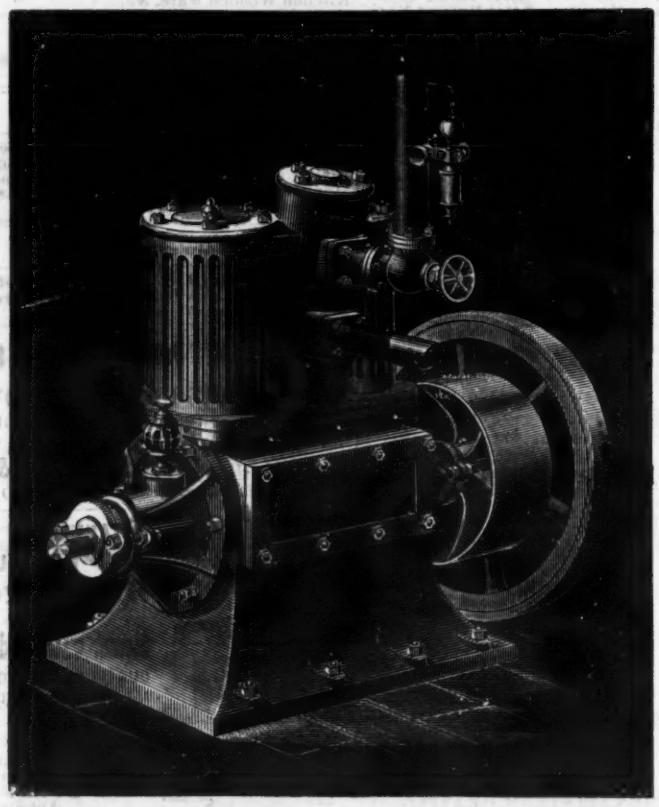
Rear view, with one Fly Wheel removed.



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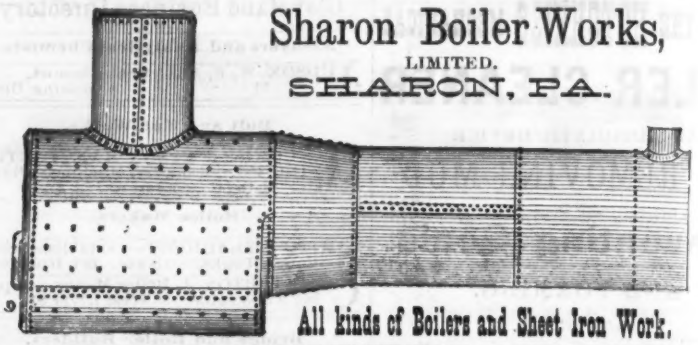

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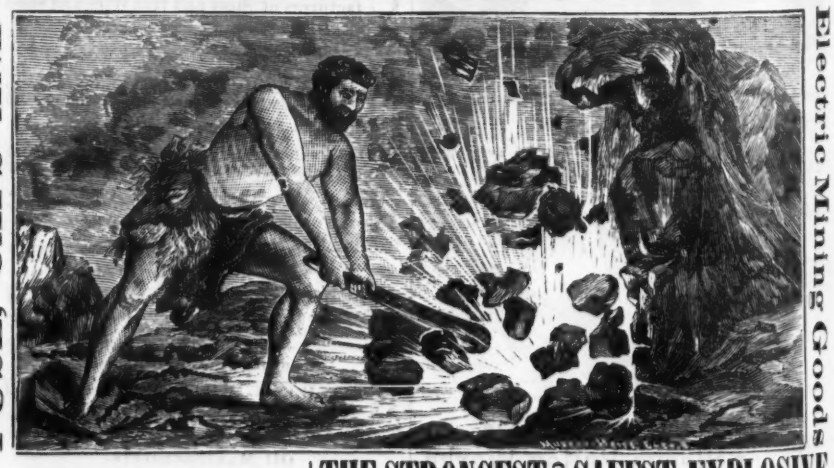

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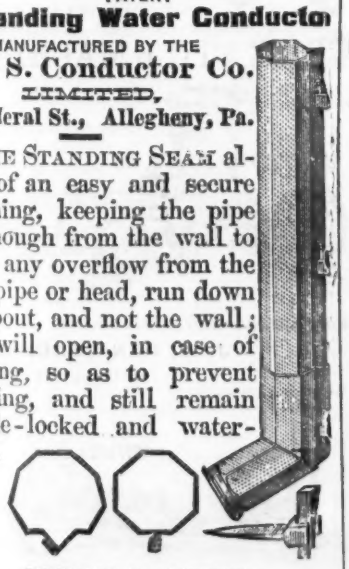

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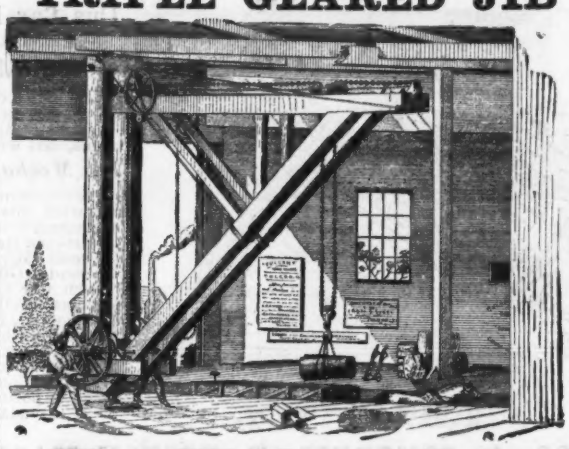

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Respectfully,
BUCHER, GIBBS & CO.
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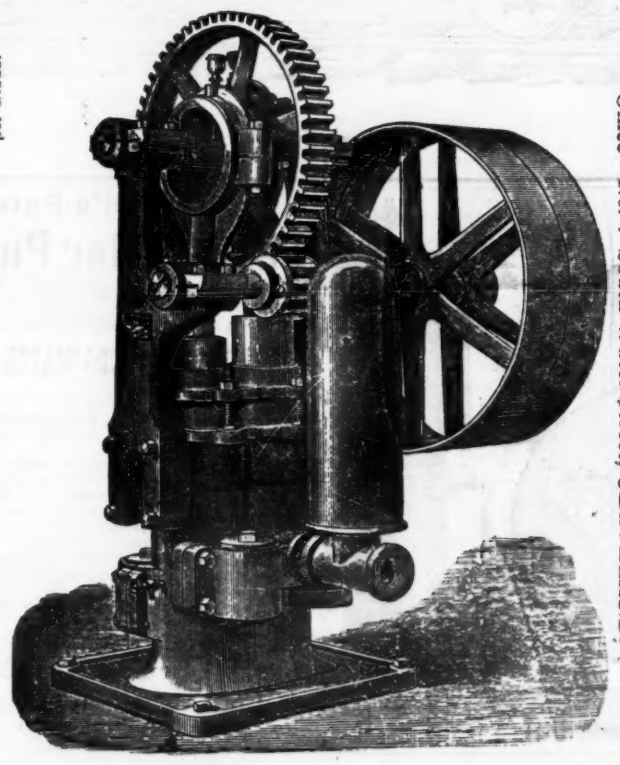

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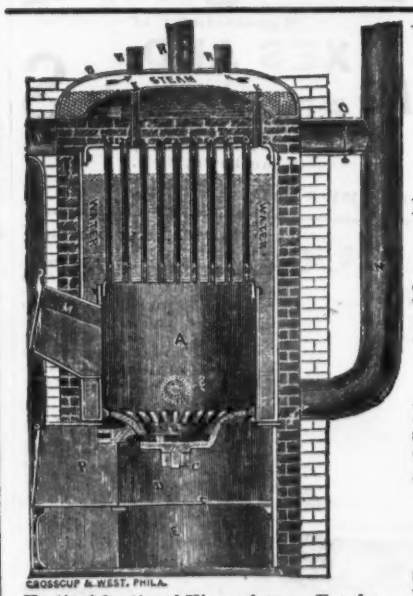

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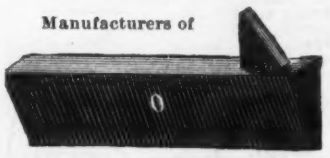

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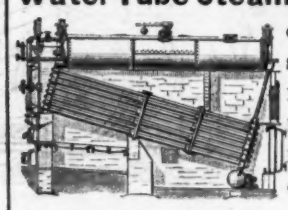

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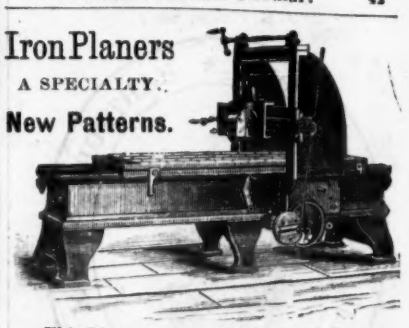
New Patterns.



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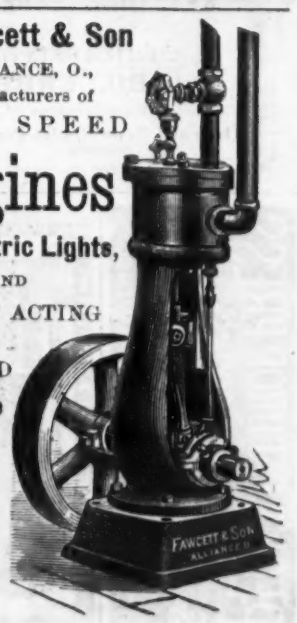

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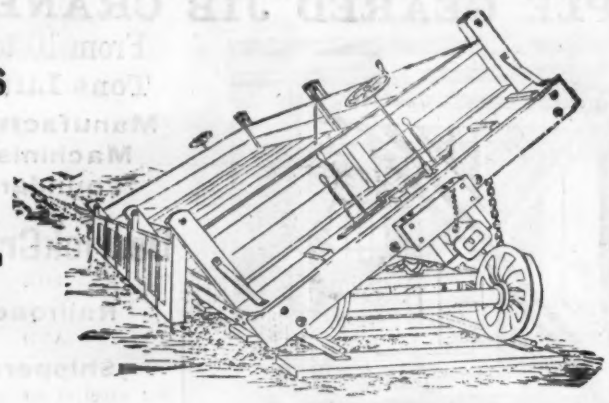
United States Car Co.'s

SCREW LEVER

Dump and Coal Car.

(M. VAN WORMER'S PATENTS.)

C. L. VAN WORMER,
General Manager.



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This Car has a capacity of 18 to 20 tons,
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The device can be applied to flat cars. The car is under perfect control at all times, and can be held at any elevation or dumped suddenly if desired. For construction trains, cars with this device would be invaluable

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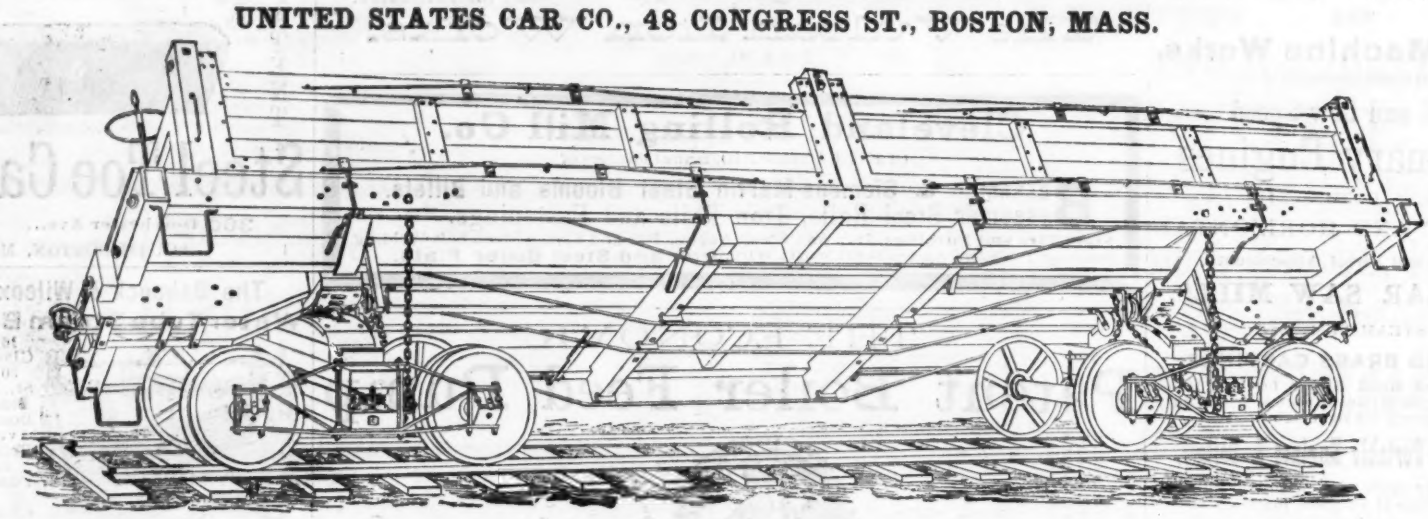

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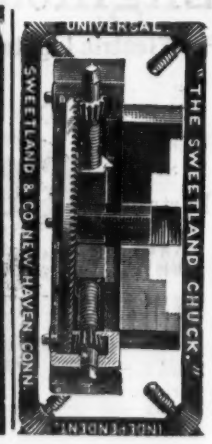

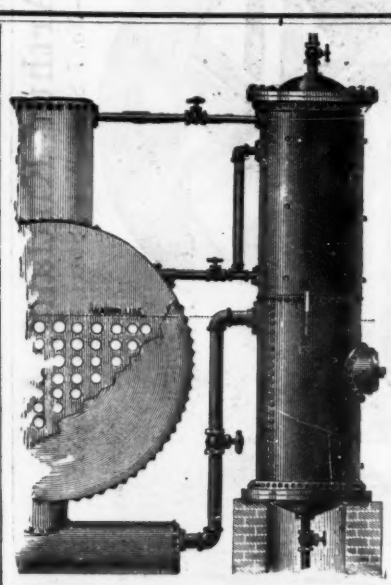

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Feed-Water Purifier,

(Patented March 13, 1883.)

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OVER ALL OTHERS:

1. It does purify the feed-water and deliver it to the boiler freed from scale-producing elements and sediment.
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3. It can be used equally well with all kinds of boilers, high or low pressure, and whether a steam engine is used or not.
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Manufactured exclusively by
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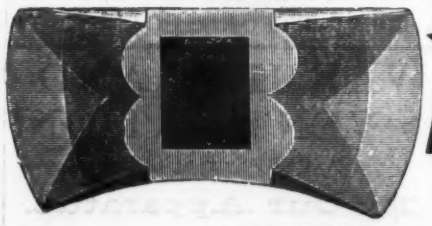

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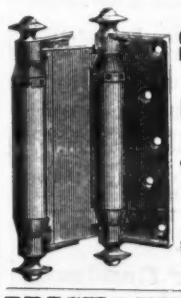

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SPIRAL SPRING HINGE,
has the lightest and
Most Elastic Movement
combined with
THE GREATEST POWER
Manufactured by
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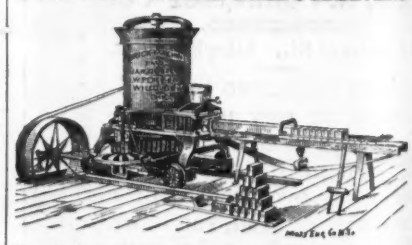

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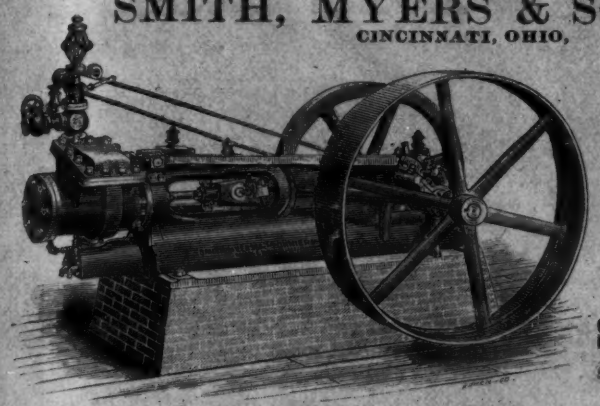

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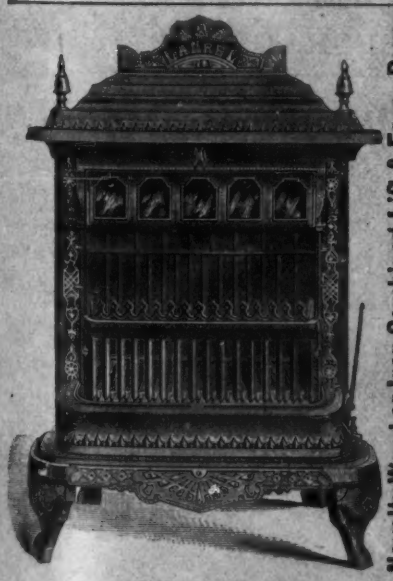

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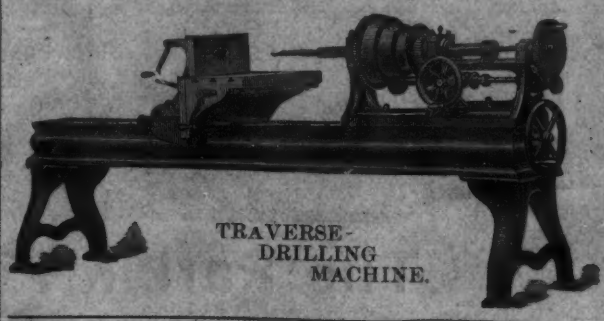

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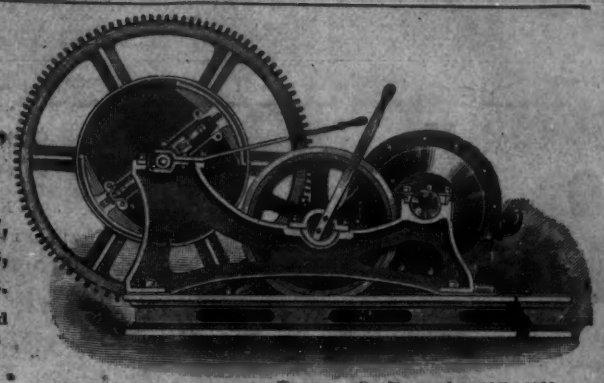

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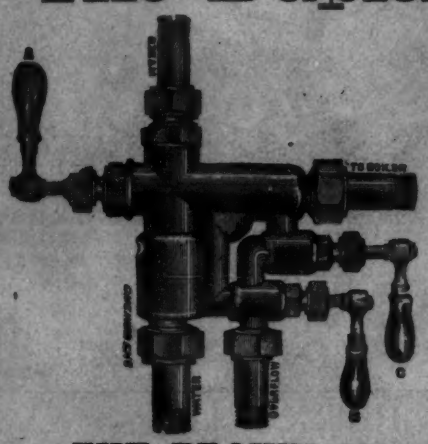

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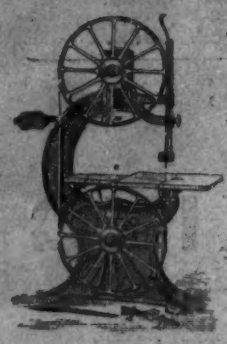

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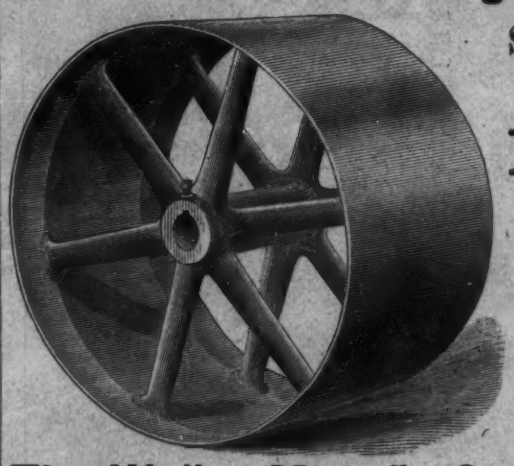

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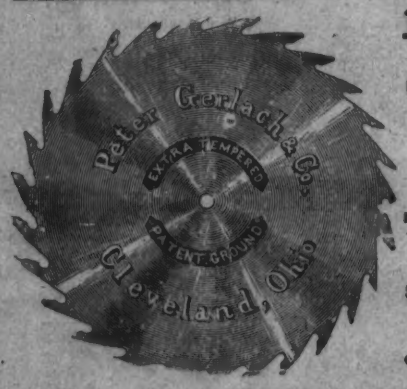

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